

# 16th and 17th Quarters Performance Monitoring Report for Interim Measure Density-Driven Convection System near Former Building 2-66

**Boeing Plant 2  
Seattle/Tukwila, Washington**

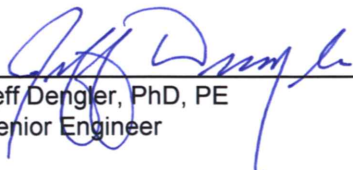
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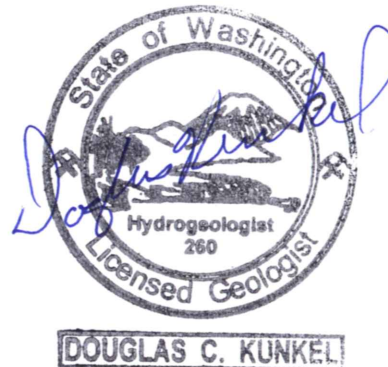
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- Attachment A – Performance Monitoring - Field Parameter Measurements
- Attachment B – Analytical Data Validation Report

## ACRONYMS

ARI	Analytical Resources, Incorporated
bgs	below ground surface
cfm	cubic feet per minute
COC	contaminant of concern
DCE	dichloroethene
DDC	density-driven convection
DO	dissolved oxygen
EPA	United States Environmental Protection Agency
EPI	Environmental Partners, Inc.
ERD	enhanced reductive dechlorination
IM	Interim Measure
mg/L	milligrams per liter
µg/L	micrograms per liter
ng/L	nanograms per liter
NGVD	National Geodetic Vertical Datum
ORP	oxidation-reduction potential
PID	photoionization detector
PPM	priority pollutant metals
ppbv	parts per billion by volume
PSCAA	Puget Sound Clean Air Agency
scfm	standard cubic feet per minute
SVE	soil vapor extraction
TCE	trichloroethene
VC	vinyl chloride
VOC	volatile organic compound
wc	water column

## 1.0 INTRODUCTION

This report presents information and data on the 16th and 17th quarters of performance monitoring of the Density-Driven Convection (DDC) System (System) located near the former Building 2-66 in the southwest corner of Boeing Plant 2. The report covers data for the 16th and 17th quarters, from May 16, 2008 through November 7, 2008.

In a letter dated August 4, 2006 from the United States Environmental Protection Agency Region X (EPA) to Boeing, EPA indicated that reporting of DDC System quarterly performance monitoring was to continue on a semi-annual basis. Boeing requested EPA approval to terminate operation of the DDC System. EPA responded to Boeing in a letter dated August 14, 2007 and agreed that the DDC System operation could be terminated but data logger measurements and quarterly groundwater monitoring would continue "until future decisions regarding this area are made." Boeing terminated operation of the DDC System on August 24, 2007.

In a letter dated August 26, 2008, Boeing requested EPA approval to terminate collection of groundwater elevation data in the remaining data loggers in the 2-66 sheetpile area since such monitoring has occurred for fifteen quarters and its purpose was served. EPA responded in a letter dated September 12, 2008, denying this request, indicating eight consecutive quarters of monitoring was needed and instructing Boeing to continue collection of groundwater elevation data for four additional quarters. Accordingly, groundwater elevation monitoring will end with the August 2009 quarter.

Boeing submitted a work plan titled Interim Measure Work Plan for 2-66 Sheetpile (EPI, 2008a), which was approved by EPA in a letter dated August 11, 2008. This new interim measure (IM) uses in-situ enhanced reductive dechlorination (ERD) to remediate chlorinated VOCs remaining in groundwater inside of the sheetpile following termination of the DDC System. Fieldwork, including groundwater monitoring, for the 2-66 ERD IM began in October 2008, replacing groundwater monitoring for the 2-66 DDC IM. Due to the start of groundwater monitoring for the 2-66 ERD IM in October 2008, quarterly DDC IM performance monitoring data are presented in this report for the 16th quarter only. Future groundwater sampling and data reports for groundwater conditions within the 2-66 sheetpile will be prepared and submitted to EPA following the schedule outlined in Interim Measure Work Plan for 2-66 Sheetpile (EPI, 2008a).

Historically there was an underground trichloroethene (TCE) tank and piping system outside the southwest corner of former Building 2-66. Soil and groundwater impacts from this former tank and piping were noted during environmental investigations. In 1993, an IM consisting of interlocking steel sheetpiles was installed around approximately 90% of the mass of TCE contamination. The sheetpiles extend to a depth of approximately 50 feet below ground surface (bgs). Figure 1 shows the site of the former Building 2-66 along the Duwamish Waterway and the location of the DDC System within the 2-66 sheetpile containment area.

Based on soil and groundwater data, the majority of the contaminant mass inside the sheetpile is located at depths shallower than 20 feet bgs. The contaminants of concern (COCs) for the area enclosed by the sheetpile include TCE and its degradation products cis-1,2-dichloroethene (DCE)

and vinyl chloride (VC). The sheetpile IM appears to be successful in fulfilling the objective of containing the contaminant mass and preventing its migration by groundwater transport (Weston, 2001).

Descriptions of the DDC technology and its applicability to the type and distribution of contaminants within the former Building 2-66 sheetpile area are provided in the IM Work Plan, dated October 28, 2003 (EPI, 2003). A description of sampling activities to be performed during and after installation is also presented in the plan. The IM Work Plan was prepared, approved, and implemented under the Administrative Order on Consent between Boeing and EPA, dated January 18, 1994.

System installation took place in late 2003 and early 2004. Details of the installation are reported in "Construction Report for Interim Measures Density-Driven Convection System near Former Building 2-66", dated November 29, 2004 (EPI, 2004a). The DDC System consists of two DDC wells installed within the sheetpile structure and 11 new monitoring wells/piezometers installed inside and outside of the sheetpile structure. Soil and groundwater were sampled and analyzed as part of the installation and those results are also presented in the Construction Report (EPI, 2004a). Figure 2 is a schematic diagram of the DDC System equipment and Figure 3 shows the performance monitoring well network.

## 2.0 OPERATIONAL MONITORING SUMMARY

The DDC System began operation on March 23, 2004 and was terminated per EPA approval on August 24, 2007. Therefore, there are no new operational data for the 2-66 DDC IM for the 16th and 17th quarters. Details of historical DDC System operation and groundwater and vapor operational and performance monitoring results are presented in the previous 2-66 DDC IM reports in the following list.

- |                                  |                                       |              |
|----------------------------------|---------------------------------------|--------------|
| • 1st Quarterly Report           | July 22, 2004 to October 23, 2004     | (EPI, 2005a) |
| • 2nd Quarterly Report           | October 24, 2004 to February 4, 2005  | (EPI, 2005b) |
| • 3rd Quarterly Report           | February 5, 2005 to May 5, 2005       | (EPI, 2005c) |
| • 4th Quarterly Report           | May 6, 2005 to August 1, 2005         | (EPI, 2005d) |
| • 5th Quarterly Report           | August 2, 2005 to November 4, 2005    | (EPI, 2006a) |
| • 6th Quarterly Report           | November 5, 2005 to February 10, 2006 | (EPI, 2006b) |
| • 7th Quarterly Report           | February 11, 2006 to May 4, 2006      | (EPI, 2006c) |
| • 8th Quarterly Report           | May 5, 2006 to August 8, 2006         | (EPI, 2006d) |
| • 9th Quarterly Report           | August 9, 2006 to November 9, 2006    | (EPI, 2007a) |
| • 10th and 11th Quarterly Report | November 10, 2006 to May 3, 2007      | (EPI, 2007b) |
| • 12th and 13th Quarterly Report | May 4, 2007 to November 16, 2007      | (EPI, 2008b) |
| • 14th and 15th Quarterly Report | November 17, 2007 to May 15, 2008     | (EPI, 2008c) |

### 3.0 PERFORMANCE MONITORING

The primary objective of the IM was to remove contaminant mass from the subsurface within the sheetpile structure. Performance monitoring of wells inside and outside the sheetpile structure is conducted quarterly to measure changes in groundwater quality that resulted from DDC operations and evaluate if DDC operation caused contaminated groundwater to escape from the sheetpile structure. Groundwater monitoring for the 16th quarterly event was performed on August 3 through August 6, 2008.

#### 3.1 Methodology

Groundwater samples were collected from 33 monitoring wells and piezometers located inside and outside the sheetpile structure. Sampled wells are listed below and their locations are shown in Figure 3.

• PL2-JF01AR*	• PL2-021C	• PP-1B-I
• PL2-JF01B*	• PL2-030A*	• PP-1B-O
• PL2-JF01C*	• PL2-030C*	• PP-2B-I
• PL2-007A	• PL2-031A	• PP-2B-O
• PL2-041AA (008A)	• PL2-032A	• PP-3A-I
• PL2-008B	• PL2-034A	• PP-3B-I
• PL2-008C	• PL2-035A	• PP-3C-I
• PL2-010A	• PL2-043B*	• PP-4B-I
• PL2-017A	• PL2-044B*	• PP-4B-O
• PL2-021A	• DDC2-66-1	• PP-5B-I
• PL2-021B	• DDC2-66-2	• PP-5B-O

(\* indicates wells common with the Shoreline Monitoring Program  
that are sampled as part of that program and the data are shared)

Groundwater samples were collected using the methods and procedures presented in the Sampling and Analysis Plan that is Attachment A of the IM Work Plan (EPI, 2003). Groundwater samples were analyzed for VOCs by Method 8260B, priority pollutant metals (PPM) by EPA 6000 and 7000 Series methods, low-level mercury by SW Method 7470A, and geochemical parameters by various methods. Samples from most wells were analyzed for VOCs, PPM, and low-level mercury. Samples from wells PL2-010A, PL2-021A, and PL2-021B were also analyzed for geochemical parameters. Samples from DDC2-66-1 and DDC2-66-2 were analyzed for geochemical parameters only.

#### 3.2 Quarterly Sampling Results

##### 3.2.1 VOC Performance Monitoring Results

Table 1 presents the August 2008 (16th) quarterly monitoring analytical results for VOCs in groundwater. Baseline results from December 2003 and previous quarterly monitoring events are also presented for comparison. Figures 4a through 4k are plots of the same VOC data for the

baseline and quarterly monitoring events. Total VOC concentration data by well location and depth of screened interval for the 16th quarter and previous sampling events are presented in Table 2.

Analysis of total VOC concentration data for each monitoring well was performed and is presented in the table below. By noting whether total concentrations increased or decreased from quarter to quarter for each well, an increasing trend, decreasing trend, or no change in concentration was determined. The comparison criterion to indicate changes in total VOC concentration is based on a difference of 30%, which is identical to the criterion that the analytical laboratory uses to evaluate reproducibility of duplicate organic analytical samples.

Comparison	Number of Wells with <u>Increases</u> in Total VOCs	Number of Wells with <u>Decreases</u> in Total VOCs	Number of Wells with <u>No Change</u> in Total VOCs
Baseline to 1 <sup>st</sup> Quarter	8	14	9
1 <sup>st</sup> Quarter to 2 <sup>nd</sup> Quarter	7	9	15
2 <sup>nd</sup> Quarter to 3 <sup>rd</sup> Quarter	6	9	16
3 <sup>rd</sup> Quarter to 4 <sup>th</sup> Quarter	5	6	20
4 <sup>th</sup> Quarter to 5 <sup>th</sup> Quarter	2	6	23
5 <sup>th</sup> Quarter to 6 <sup>th</sup> Quarter	9	5	17
6 <sup>th</sup> Quarter to 7 <sup>th</sup> Quarter	6	9	16
7 <sup>th</sup> Quarter to 8 <sup>th</sup> Quarter	9	5	17
8 <sup>th</sup> Quarter to 9 <sup>th</sup> Quarter	3	12	16
9 <sup>th</sup> Quarter to 10 <sup>th</sup> Quarter	9	4	18
10 <sup>th</sup> Quarter to 11 <sup>th</sup> Quarter	6	7	18
11 <sup>th</sup> Quarter to 12 <sup>th</sup> Quarter	7	7	17
12 <sup>th</sup> Quarter to 13 <sup>th</sup> Quarter	5	6	20
13 <sup>th</sup> Quarter to 14 <sup>th</sup> Quarter	5	7	19
14 <sup>th</sup> Quarter to 15 <sup>th</sup> Quarter	6	5	20
15 <sup>th</sup> Quarter to 16 <sup>th</sup> Quarter	4	5	22

Although the numbers in the table continue to fluctuate somewhat over recent quarters, some stabilization of the groundwater regime is apparent in the general trend, with the number of wells showing no change in total VOC concentrations from quarter to quarter more than doubling since the start of the IM. This indicates that DDC operation progressed in the removal of VOCs from within the sheetpile and, secondarily, that the effectiveness rate of DDC operation at VOC removal decreased, which prompted Boeing to request EPA approval to terminate DDC operation and for EPA to approve that request.

Table 2 presents total VOC concentrations grouped by wells located inside or outside the sheetpile structure, and by the depth of the screened interval: A level, B level, or C level. Data are presented for baseline and subsequent quarters of operation along with an average

concentration for each level of the aquifer. Only the average for the A level wells inside the sheetpile has appreciably decreased; all other averages have remained relatively unchanged.

Since the DDC system was shut down in August 2007 samples from several wells in and around the 2-66 sheetpile indicate VOC concentration increases and decreases have occurred in select locations. For example, an increase in the VC concentration was noted in the May and August 2008 samples from PP-2B-I, which is inside the sheetpile wall. This increase in concentration is likely due to diffusion of VC from lower permeability layers and lenses into groundwater after operation of the DDC system was terminated in 2007. This is a well-documented occurrence in pump and treat, air sparging, and soil vapor extraction systems, and is commonly referred to as "rebound." Monitoring of well PP-2B-I is included in the well network for the Enhanced Reductive Dechlorination (ERD) IM, which is currently being implemented inside the 2-66 sheetpile; as such, constituent concentrations in samples from that well are being tracked as part of the ongoing, Phase 3 IM inside the sheetpile.

The increased VC concentrations noted in samples from PP-2B-O, beginning with the August 2007 sampling event, do not appear to be related to groundwater from inside the 2-66 sheetpile. The basis for this observation is that analytical data indicate VC concentrations in samples from PP-2B-I, its paired well inside the sheetpile, are significantly lower than VC concentrations in samples from PP-2B-O, located outside the sheetpile, during all but three quarterly monitoring events throughout the 17 quarterly periods presented in this report.

Based on the highly variable VC concentrations exhibited over time in samples from PP-2B-O, the recent increase in VC concentrations may be due to temporal and tidal variability. Daily tidal fluctuations change hydraulic gradients near the Duwamish Waterway, resulting in daily changes to groundwater flow patterns near the 2-66 sheetpile. The variable groundwater flow patterns caused by tidal fluctuations are further affected by the 2-66 sheetpile, which forces A level and most B level groundwater to flow around the structure. These site-specific factors could produce the small fluctuations in VC concentrations that are reflected in the PP-2B-O VOC time-concentration plot presented in Figure 4i.

Similarly, a slight cis-1,2-DCE concentration increase was measured in the August 2008 sample from PP-5B-O, one year after the operation of the DDC system was terminated in August 2007. Concentrations of cis-1,2-DCE in samples from PP-5B-O were non-detect for the two quarterly monitoring results prior to system shut down, and remained non-detect for three quarterly results following system shut down. This long continuous period of non-detections occurring both during and after DDC system operation suggests that the August 2008 6.6 µg/L detection of cis-1,2-DCE in PP-5B-O is not related to DDC system operation or to its shut down. The 6.6 µg/L concentration of cis-1,2-DCE detected in August 2008 is not a particular concern because it is significantly less than the cis-1,2-DCE groundwater screening level of 1,550 µg/L. Nonetheless, VOC data from shoreline monitoring wells located downgradient of PP-5B-O will be used to evaluate if this slight concentration increase in cis-1,2-DCE represents a concern.

Since the startup of the DDC IM, groundwater total VOC concentrations for most wells have decreased. Current changes are likely affected by local scale variation and natural attenuation since operation of the DDC System was terminated in August 2007. Wells with no change in Table 2 are mainly B and C level wells with initially relatively low total VOC concentrations and/or with total VOC concentrations that quickly decreased and equilibrated to low values in response to DDC System operation.

### **3.2.2 Metals and Alkalinity Performance Monitoring Results**

While the DDC System was operational, an acid metering system was used to maintain sufficiently low pH in the DDC wells and infiltration galleries to prevent plugging by iron precipitation or other reaction products formed by introduction of oxygen in the groundwater. This pH adjustment has the potential to mobilize metals in groundwater. Performance monitoring data for metals were evaluated to determine if metals mobilization was an issue.

Table 3 presents the quarterly analytical results for metals in groundwater for the 16th quarter. With the exceptions of PL2-010A and PL2-021A, which are located immediately adjacent to the DDC wells, the metals analysis results are essentially the same as reported for the baseline and subsequent quarterly sampling events. The data indicate that the pH adjustment inside the DDC wells did not mobilize metals in a large area inside the sheetpile structure. Air injection, which could potentially change subsurface geochemical conditions, also did not appear to mobilize metals.

Tables 4a, 4b, and 4c present baseline and quarterly analytical results for geochemical parameters total and dissolved metals (i.e., calcium, iron, and manganese) and alkalinity in groundwater in selected wells. Total and dissolved metals concentrations inside the DDC wells were approximately two to five times greater than baseline concentrations. As noted above, metals concentrations at nearby wells PL2-010A and PL2-021A showed similar increases. However, metals concentrations did not increase in the equally close but deeper well PL2-021B.

Acidification appears to have a limited impact outside of the DDC wells. This conclusion is supported by the pH data measured during each well sampling event and the buffering capacity calculation performed during DDC System design. Attachment A of this document contains field data summaries, which indicate that most sampled wells have pH levels approximately in the neutral range of 6 to 8. Wells PL2-010A and PL2-021A had the lowest measured pH levels, which is expected because both wells are close to the DDC wells where the acidification occurred.

Low-level total mercury concentrations in groundwater are presented in Table 5. During the August 2008 quarterly performance sampling event, total mercury was detected at 0.030 micrograms per liter ( $\mu\text{g/L}$ ) concentration at PL2-008C and was non-detect at 0.020  $\mu\text{g/L}$  for all other wells. It does not appear that mercury has been mobilized by historical operation of the DDC System.

## **4.0 GROUNDWATER ELEVATION MEASUREMENT**

The objective of groundwater elevation measurements was to assure that the sheetpile structure remained effective for containment of the bulk of the contamination and that no harm was done to the environment by DDC System operation.

### **4.1 Data Logger Water Level Measurements**

Groundwater levels were measured at 30-minute intervals using data loggers in piezometer pairs PP-1B-I/PP-1B-O and PP-2B-I/PP-2B-O to evaluate the potential that DDC System operation might induce migration of contaminated groundwater from inside to outside of the sheetpile structure. DDC System operation was terminated in August 2007 and, therefore, groundwater levels for the 16th and 17th quarters represent conditions unaffected by DDC System operation.

The paired piezometers are located on the periphery of the sheetpile structure (see Figure 3) nearest the two DDC wells with the piezometer inside the sheetpile designated “-I” and the piezometer outside the sheetpile designated “-O.” The paired piezometers are screened at the bottom of the sheetpile at approximately 50 feet bgs. Figures 5a, 5b, 6a, and 6b present hydrograph plots of water level measurements for the piezometer pairs PP-1B-I/PP-1B-O and PP-2B-I/PP-2B-O for the 16th and 17th quarters.

High frequency groundwater elevation changes represent the impact of the daily tidal cycles of the Duwamish Waterway. Low frequency groundwater elevation changes represent the monthly effect of the phase of the moon on tides.

### **4.2 Observations**

Hydrographs for quarters with the DDC System running compared with 16th and 17th quarter data with the DDC System operation terminated indicate that there were no significant differences in the relationship between groundwater elevations inside and outside the sheetpile structure as a result of DDC System operation. The hydrographs demonstrate that there was no measurable evidence that DDC System operation increased the potential flow of groundwater from inside the sheetpile to outside the sheetpile beyond that which may occur due to tidal fluctuations.

The hydrographs indicate that water levels inside of the sheetpile are sometimes higher and sometimes lower than water levels outside of the sheetpile as the result of a time lag in tidal response inside the sheetpile and this condition is apparently unaffected by DDC System operation based on water level data. A potentially unacceptable condition would be if the water level inside the sheetpile were consistently and significantly higher than outside of the sheetpile because of DDC System operation. That hydraulic condition, if sustained, could cause groundwater from inside the sheetpile structure to flow outside of the sheetpile. No such condition was observed during DDC System operation. Groundwater elevation data, along with water quality data in the wells surrounding the sheetpile, indicate that the “do no harm” principle is being maintained.

Hydrographs demonstrate that groundwater level elevations fluctuate over a greater range for the piezometers outside of the sheetpile relative to the piezometers inside the sheetpile, especially for the PP-2B pair, which is closer to the waterway. This occurs because the sheetpile dampens the effects of Duwamish Waterway tide changes on groundwater levels within the sheetpile. Quarterly ranges of water level fluctuations are presented in the table below "Comparison of Water Level Fluctuations in Piezometers."

<b>Comparison of Water Level Fluctuations in Piezometers</b>														
(data below represent range of water level elevations in feet NGVD 29)														
		Quarter												
Piezometer	Startup	1st	2nd	3rd	4th	5 <sup>th</sup>	6th	7th	8th	9th	10 <sup>th</sup> - 11 <sup>th</sup>	12 <sup>th</sup> -13 <sup>th</sup>	14 <sup>th</sup> - 15 <sup>th</sup>	16 <sup>th</sup> - 17 <sup>th</sup>
PP-1B-I	0.9	0.9	0.9	1.1	0.9	0.7	1.6	1.1	1.0	2.1	1.3	1.8	1.6	1.7
	to	to	to	to	to	to	to	to	to	to	to	to	to	to
	2.7	2.6	2.9	3.0	2.9	2.8	4.3	3.4	2.6	3.7	3.2	3.8	3.7	3.6
PP-1B-O	0.9	0.7	0.8	1.1	1.0	0.7	1.5	1.0	1.0	2.0	1.1	1.6	1.6	1.7
	to	to	to	to	to	to	to	to	to	to	to	to	to	to
	2.8	2.8	3.1	3.2	2.9	3.0	4.5	3.4	2.7	3.6	3.3	3.7	3.8	3.7
PP-2B-I	-1.4	-1.3	-0.8	-1.1	-1.2	-1.5	-0.8	-1.2	0.5	-0.6	-1.3	-0.4	0.4	1.3
	to	to	to	to	to	to	to	to	to	to	to	to	to	to
	3.9	3.8	4.0	3.6	3.9	3.7	4.8	4.0	7.6	3.7	4.3	4.2	5.2	5.6
PP-2B-O	-2.6	-2.3	-1.9	-2.4	-2.4	-2.3	-3.0	-3.0	0.5	-2.5	-2.3	-0.8	-0.3	-0.3
	to	to	to	to	to	to	to	to	to	to	to	to	to	to
	4.8	4.8	5.0	5.2	5.0	4.8	5.1	4.6	7.7	4.7	6.4	6.2	7.2	6.4

The consistency shown in the above table and in comparing quarterly report water level plots indicates that there was no measurable impact from operation of the DDC System that would cause groundwater to flow beneath the sheetpile structure. This same conclusion has been made in all previous quarterly reports.

Boeing requested EPA approval to terminate collection of groundwater elevation data in the remaining data loggers in the 2-66 sheetpile area in a letter to EPA dated August 26, 2008. EPA denied this request and instructed Boeing to continue collection of groundwater elevation data for four additional quarters. The four quarter period required by EPA will end with the August 2009 quarter at which time water level elevation monitoring with data loggers will be terminated.

## 5.0 CONCLUSIONS

Operational and performance monitoring provided data to assess groundwater remediation within the 2-66 IM sheetpile and physical removal of VOCs from the subsurface. Soil sampling inside the 2-66 sheetpile was performed in September 2006 to provide an updated total VOC mass within the sheetpile in both soil and groundwater. A report titled "Interim Measure Evaluation and Completion Report at the Building 2-66 Sheetpile" (EPI, 2007c), submitted to EPA in mid-May 2007 summarized this work and the overall results of DDC System performance.

This analysis indicated total VOC mass reductions of approximately 98% for groundwater and soil combined have occurred over the period from May 2003 to September 2006. The May 2003 estimate of total VOC mass in soil was 8,012 pounds and the September 2006 estimate of total VOC mass in soil was 174 pounds. The May 2003 estimate of total VOC mass in groundwater was 716 pounds and the September 2006 estimate of total VOC mass in groundwater was 21 pounds.

Boeing proposed that the reduced levels of VOC mass left inside the sheetpile would be more efficiently remediated by a method other than continued operation of the two DDC wells. Subsequently, in an August 14, 2007 letter from EPA to Boeing, EPA approved termination of DDC System operation. Boeing terminated DDC System operation on August 24, 2007.

It has been approximately one year since the DDC System was shut down and performance monitoring data indicate negligible impact of the shutdown with respect to rebound of groundwater VOC concentrations. A review of the VOC trend plots presented in Figure 4 indicates that in samples from nearly all wells there is quarterly variation of groundwater VOC concentrations since August 2007 but with no apparent trend of the data.

A possible exception to this conclusion is PL2-021A. TCE and DCE groundwater concentrations in samples from this location have increased from their lowest concentrations during DDC system operation but are still two orders of magnitude less than the 2003 baseline concentrations. If this apparent upward trend is not due to local scale variability, it may be due to equilibrium partitioning of VOC compounds from the soil to groundwater. PL2-021A is immediately adjacent to DDC2-66-1, which was the most impacted sampling location inside of the sheetpile based on historical soil and groundwater data. The lack of groundwater mixing and remediation by well DDC2-66-1 since DDC System shutdown may have allowed VOC concentrations in groundwater to increase slightly in the immediate area around PL2-021A due to dissolution from residual VOC-impacted soil. No similar trends are apparent in data from PL2-021B and PL2-021C, which are deeper wells at the same location. Similarly, there is no apparent groundwater VOC concentration trend at PL2-010A, which is the well located closest to DDC2-66-2, historically the second most impacted area inside of the sheetpile structure.

Metals concentrations increased from two to five times from baseline (December 2003) to 16th quarter (August 2008) for groundwater samples from both DDC wells and nearby wells PL2-010A and PL2-021A because of pH adjustment necessary for DDC System operation. Metals results

for groundwater from the deeper nearby well PL2-021B and from other wells inside the sheetpile structure were unchanged to marginally lower. These data demonstrated that the metals mobilization effect of pH adjustment at the DDC wells remained localized to the immediate area of the DDC wells.

Water level measurement data have been consistent over three years of continuous DDC System operation. Based on these data, there is no measurable evidence that DDC System operation increased the potential flow of contaminated water from inside the sheetpile to outside the sheetpile beyond that which occurs due to natural tidal fluctuations.

In a work plan titled Interim Measure Work Plan for 2-66 Sheetpile (EPI, 2008a) Boeing proposed further groundwater remediation using in-situ ERD to dechlorinate the bulk of the remaining chlorinated VOCs in groundwater within the 2-66 sheetpile. EPA approved the work plan in a letter dated August 11, 2008. The approved ERD IM has been initiated and groundwater monitoring is being performed following the monitoring program specified in that work plan.

## 6.0 SCHEDULE

This report concludes the DDC IM monitoring and reporting program with the exception of a short letter report that will submit water level elevation data collected through August 2009 as discussed in Section 1.0 above. Future quarterly monitoring and semi-annual reporting for groundwater quality conditions inside of the 2-66 sheetpile will follow the schedule presented in the EPA approved Interim Measure Work Plan for 2-66 Sheetpile (EPI, 2008a).

For the reader's information, the schedule below gives the dates of completed events and expected future performance monitoring and reporting events associated with the 2-66 ERD IM phase. The schedule may be adjusted to accommodate additional nutrient substrate injections based on results of the quarterly performance monitoring events provided for in that work plan.

**Schedule for the Current 2-66 ERD IM**

September 2008	Baseline Monitoring
October 2008	Nutrient Substrate Injection
January 2009	1st Quarter of Performance Monitoring
April 2009	2nd Quarter of Performance Monitoring
July 2009	1st Semi-annual Report
July 2009	3rd Quarter of Performance Monitoring
October 2009	4th Quarter of Performance Monitoring
January 2010	2nd Semi-annual Report

## 7.0 REFERENCES

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EPI, 2006d	Environmental Partners, Inc. "Eighth Quarterly Performance Monitoring Report for Interim Measures Density-Driven Convection System near Former Building 2-66." Boeing Plant 2 Seattle/Tukwila, Washington. October 27, 2006.
EPI, 2007a	Environmental Partners, Inc. "Ninth Quarterly Performance Monitoring Report for Interim Measures Density-Driven Convection System near Former Building 2-66." Boeing Plant 2 Seattle/Tukwila, Washington. February 7, 2007.
EPI, 2007b	Environmental Partners, Inc. "Tenth and Eleventh Quarterly Performance Monitoring Report for Interim Measures Density-Driven Convection System near Former Building 2-66." Boeing Plant 2 Seattle/Tukwila, Washington. July 24, 2007.
EPI, 2007c	Environmental Partners, Inc. "Interim Measure Evaluation and Completion Report at the Building 2-66 Sheetpile." Boeing Plant 2 Seattle/Tukwila, Washington. May 14, 2007.
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## Tables

**Table 1. Quarterly Performance Monitoring Analytical Results - Chlorinated VOCs in Groundwater (units of µg/L)**  
2-66 IM DDC System

[illegible]

Notes:

U = non-detect, result below indicated detection limit

dup = duplicate sample

NOTE: DDC wells shut-down 8/24/07

**Table 2. Average and Total VOC Concentrations by Well Location and Level**

Wells	Total VOC Concentrations (µg/L) by Quarter																
Inside Sheetpile	Baseline	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th	16th
<u>A-Level Wells</u>																	
	(12/03)	(9/04)	(2/05)	(5/05)	(8/05)	(11/05)	(2/06)	(5/06)	(8/06)	(11/06)	(2/07)	(5/07)	(8/07)	(11/07)	(2/08)	(5/08)	(8/08)
PL2-010A	15,600	580	167	244	313	232	204	91	133	141	109	859	440	353	488	745	670
PL2-017A	3	4	5	5	2	3	5	6	2	6	3	3	2	2	3	3	3
PL2-041AA(008A)	1,374	4,850	3,410	3,030	2,650	2,250	1,990	1,340	2,260	1,680	1,340	610	1,270	1,120	1,001	900	900
PL2-021A	639,000	1,760	2,125	400	246	277	740	590	1,290	560	559	1,739	2,200	2,831	4,008	4,400	3,732
PL2-031A	41	51	31	173	41	39	39	29	53	46	109	23	18	11	6	17	13
PL2-032A	13,700	4,300	5,950	6,050	7,950	9,200	7,100	78	14,600	6,390	97	8,100	3,044	2,800	1,400	850	1,100
PL2-035A	23,350	490	13,700	13,302	10,350	8,400	12,500	13,100	13,742	3,810	18,500	18,000	14,300	11,200	16,100	18,005	12,500
PP-3A-I	2,224	14,100	8,800	1,900	823	388	418	116	125	65	1,046	211	51	141	93	99	58
Average A-Level	86,911	3,267	4,273	3,138	2,797	2,599	2,875	1,919	4,026	1,587	2,720	3,693	2,666	2,307	2,887	3,127	2,372
<u>B-Level Wells</u>																	
PL2-008B	7	675	479	236	894	232	293	157	530	109	275	265	105	71	48	117	32
PL2-021B	11	29	21	3	6	32	3	286	4	17	5	783	530	8	12	5	5
PP-1B-I	29	79	45	33	29	33	68	113	34	40	34	67	3	1	0	0	1
PP-2B-I	73	306	126	53	122	115	160	38	115	50	33	12	13	87	25	48	116
PP-3B-I	29	7	59	9	2	2	11	3	6	2	5	3	34	26	30	1	33
PP-4B-I	2,050	2,660	1,885	788	2,672	3,700	760	1,307	940	1,490	3,170	4,260	6,600	2,110	1,550	2,244	1,757
PP-5B-I	22	2	13	13	8	9	0	8	7	4	0	0	5	6	4	4	4
Average B-Level	317	537	375	162	533	589	185	273	234	245	503	770	1,041	330	238	346	278
<u>C-Level Wells</u>																	
PL2-008C	2	1	3	2	7	20	4	2	3	4	2	1	1	2	0	1	1
PL2-021C	96	3	3	3	3	3	2	2	2	0	2	2	1	2	1	1	1
PP-3C-I	2	305	75	19	19	11	83	13	2	1	1	0	0	2	1	0	0
Average C-Level	33	103	27	8	10	11	30	6	2	2	2	1	1	2	1	1	1
Outside Sheetpile	Baseline	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th	16th
<u>A-Level Wells</u>																	
	(12/03)	(9/04)	(2/05)	(5/05)	(8/05)	(11/05)	(2/06)	(5/06)	(8/06)	(11/06)	(2/07)	(5/07)	(8/07)	(11/07)	(2/08)	(5/08)	
PL2-007AR	253	224	200	315	293	306	197	295	318	176	269	262	237	236	135	148	124
PL2-030A	805	510	9	241	126	8	148	189	18	61	3	1	5	21	0	0	0
PL2-034A	1,045	350	522	664	497	370	370	315	340	230	139	127	182	305	258	170	304
PL2-JF01AR	2,715	5,100	2,330	4,445	4,595	1,900	1,128	3,510	2,100	330	3,000	14,100	2,218	500	1,114	3,008	110
Average A-Level	1,205	1,546	765	1,416	1,378	646	461	1,077	694	199	853	3,623	661	266	377	832	135
<u>B-Level Wells</u>																	
PL2-043B	72	5	5	4	3	1	2	1	12	1	1	0	0	0	0	0	0
PL2-044B	93	3	16	5	5	1	1	1	3	0	1	0	0	0	0	0	0
PP-1B-O	53	6	25	30	17	9	18	1,886	1,800	4	3,260	1,190	1,270	9	290	402	32
PP-2B-O	522	16	333	381	249	178	507	5	22	196	180	11	416	596	525	487	557
PP-4B-O	412	345	191	2,160	973	658	3,150	3,570	1,380	580	1,120	980	8,730	2,020	640	337	904
PP-5B-O	7	8	10	7	5	6	5	4	4	1	3	0	0	0	0	0	7
PL2-JF01B	555	5	129	46	63	42	169	9	1	9	23	4	2	8	20	4	2
Average B-Level	245	55	101	376	188	128	550	782	460	113	655	312	1,488	376	211	176	215
<u>C-Level Wells</u>																	
PL2-030C	1	1	3	3	3	1	1	0	0	0	0	0	0	0	0	0	0
PL2-JF01C	1	2	3	3	3	1	1	0	2	0	0	0	0	0	0	0	0
Average C-Level	1	2	3	3	3	1	1	0	0	1	0	0	0	0	0	0	0

**Table 3. Quarterly Performance Monitoring Analytical Results - Metals in Groundwater (16th Quarter)**

**2-66 IM DDC System**

Well	Total Metals (µg/L)												
	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
PL2-007AR	50 U	1.2	1 U	2 U	5 U	3.7	1 U	6.0	50 U	0.2 U	0.2 U	24	10 U
PL2-041AA(008A)	50 U	0.8	1 U	2 U	5 U	3.5	1 U	2.3	50 U	0.2 U	0.2 U	3 U	3,090
PL2-008B	50 U	0.5 U	1 U	2 U	5 U	0.8	1 U	1.3	50 U	0.2 U	0.2 U	3 U	10 U
PL2-008C	50 U	2.5	1 U	2 U	5 U	0.8	1 U	1.3	50 U	0.2 U	0.2 U	8	10 U
PL2-010A	50 U	0.5 U	2	2 U	5 U	47.8	1 U	94.4	50 U	0.2 U	0.2 U	3 U	240
PL2-017A	50 U	1 U	1 U	2 U	5 U	2	2 U	4	50 U	0.5 U	0.5 U	3 U	10 U
PL2-021A	50 U	1.8	1 U	2 U	5 U	5.3	1 U	70.3	50 U	0.2 U	0.2 U	27	240
PL2-021A (dup)	50 U	2.0	1 U	2 U	5 U	5.2	1 U	70.2	50 U	0.2 U	0.2 U	27	250
PL2-021B	50 U	0.5 U	1 U	2 U	5 U	0.7	1 U	1.1	50 U	0.2 U	0.2 U	3 U	10 U
PL2-021C	100 U	2	2 U	4 U	10 U	2	2 U	7	100 U	0.5 U	0.5 U	6 U	20 U
PL2-030A	2 U	1.0	0.2 U	2 U	5 U	0.7	1 U	0.9	50 U	0.2 U	0.2 U	10	10 U
PL2-030C	2 U	2.15	0.2 U	2 U	5 U	2.7	1 U	1.8	0.121	0.5 U	0.2 U	7	10 U
PL2-031A	50 U	3.7	1 U	2 U	5 U	1.1	1 U	8.6	50 U	0.2 U	0.2 U	3 U	10 U
PL2-032A	50 U	1.4	1 U	2 U	5 U	0.5 U	1 U	5.3	50 U	0.2 U	0.2 U	3 U	30
PL2-034A	50 U	2.4	1 U	2 U	5 U	0.7	1 U	1.3	50 U	0.2 U	0.2 U	5	10 U
PL2-035A	50 U	1.6	1 U	2 U	5 U	0.9	1 U	13.7	50 U	0.2 U	0.2 U	3 U	10 U
PL2-035A (dup)	50 U	1.3	1 U	2 U	5 U	0.8	1 U	10.2	50 U	0.2 U	0.2 U	3 U	10 U
PL2-043B	10 U	2 U	1 U	4 U	10 U	3	5 U	8	100 U	1 U	1 U	6 U	20 U
PL2-044B	10 U	2 U	1 U	2 U	5 U	7	5 U	8	50 U	1 U	1 U	3	10 U
PL2-JF01AR	2 U	0.5 U	0.2 U	2 U	5 U	1.1	1 U	1.1	50 U	0.2 U	0.2 U	12	10 U
PL2-JF01B	4 U	0.8	0.2 U	2 U	5 U	1.5	1 U	3.0	50 U	0.2 U	0.2 U	3 U	10 U
PL2-JF01C	10 U	0.729	0.5 U	4 U	10 U	9	2 U	10	0.219	0.5 U	0.5 U	10	20 U
PP-1B-I	50 U	0.9	1 U	2 U	5 U	1.2	1 U	2.4	50 U	0.2 U	0.2 U	3 U	10 U
PP-1B-O	50 U	2	1 U	2 U	5 U	2	2 U	4	50 U	0.5 U	0.5 U	3 U	10 U
PP-2B-I	50 U	0.7	1 U	2 U	5 U	0.9	1 U	1.7	50 U	0.2 U	0.2 U	3 U	10 U
PP-2B-O	50 U	1.0	1 U	2 U	5 U	0.9	1 U	1.2	50 U	0.2 U	0.2 U	3 U	10 U
PP-3A-I	50 U	4.0	1 U	2 U	5 U	1.9	1 U	2.2	50 U	0.2 U	0.2 U	6	30
PP-3B-I	50 U	1 U	1 U	2 U	5 U	2	2 U	2	50 U	0.5 U	0.5 U	3 U	10 U
PP-3C-I	50 U	1.2	1 U	2 U	5	0.9	1 U	1.2	50 U	0.2 U	0.2 U	3 U	10 U
PP-4B-I	50 U	0.5 U	1 U	2 U	5 U	0.8	1 U	1.5	50 U	0.2 U	0.2 U	3 U	10 U
PP-4B-I (dup)	50 U	0.5 U	1 U	2 U	5 U	0.8	1 U	1.4	50 U	0.2 U	0.2 U	3 U	10 U
PP-4B-O	50 U	0.5 U	1 U	2 U	5 U	0.8	1 U	0.8	50 U	0.2 U	0.2 U	3 U	10 U
PP-5B-I	50 U	2 U	1 U	2 U	5 U	3	5 U	4	50 U	1 U	1 U	3 U	10 U
PP-5B-O	50 U	3	1 U	2 U	5 U	3	5 U	6	50 U	1 U	1 U	3 U	20

**Notes:**

U = non-detect, result below indicated detection limit

dup = duplicate sample

ND = no data

NOTE: DDC wells shut-down 8/24/07

<b>Table 4a. Quarterly Performance Monitoring Analytical Results -</b> <b>Geochemical Parameters in Groundwater - Total Metals</b> <b>2-66 IM DDC System</b>					
Date	Well	Total Metals (µg/L)			Sample ID
		Calcium	Iron	Manganese	
12/18/03	DDC2-66-1	49,900	24,900	1,410	GW-031218-DDC2-66-1-0, 15:15
9/29/04	DDC2-66-1	155,000	105,000	3,520	GW-040929-DDC2-66-1D-0, 7:40
9/29/04	DDC2-66-1(dup)	156,000	109,000	3,540	GW-040929-DDC2-66-1D-1, 7:45
2/3/05	DDC2-66-1	141,000	80,200	3,120	GW-050203-DDC2-66-1D-1, 10:25
5/3/05	DDC2-66-1	177,000	94,200	3,950	GW-050503-DDC-1D-0, 10:15
7/28/05	DDC2-66-1	209,000	98,400	5,230	GW-050728-DDC-1D-0, 11:00
11/2/05	DDC2-66-1	220,000	130,000	5,610	GW-051102-DDC-1D-0, 10:20
2/6/06	DDC2-66-1	187,000	40,800	4,870	GW-060206-DDC-1D-0, 9:50
5/3/06	DDC2-66-1	167,000	87,400	4,110	GW-060503-DDC-1D-0, 8:15
8/7/06	DDC2-66-1	137,000	68,400	3,370	GW-060807-DDC-1D-0, 10:44
11/7/06	DDC2-66-1	191,000	48,700	4,980	GW-061107-DDC-1D-0, 14:10
1/29/07	DDC2-66-1	163,000	64,400	3,430	GW-070129-DDC-1D-0, 12:25
4/30/07	DDC2-66-1	141,000	90,800	3,700	GW-070430-DDC-1D-0, 11:50
8/8/07	DDC2-66-1	137,000	71,600	3,150	GW-070808-DDC-1D-0, 9:20
11/15/07	DDC2-66-1	166,000	72,300	4,390	GW-071115-DDC-1D-0, 9:35
2/4/08	DDC2-66-1	133,000	74,800	3,270	GW-080204-DDC-1D-0, 15:20
5/15/08	DDC2-66-1	150,000	92,400	3,680	GW-080515-DDC-1D-0, 8:27
8/4/08	DDC2-66-1	123,000	85,600	3,260	GW-080804-DDC-1D-0, 15:06
12/19/03	DDC2-66-2	42,400	170	256	GW-031219-DDC2-66-2-0, 8:45
9/29/04	DDC2-66-2	73,300	10,500	617	GW-040929-DDC2-66-2D-0, 11:35
2/3/05	DDC2-66-2	136,000	77,100	3,010	GW-050203-DDC2-66-2D-0, 9:30
5/3/05	DDC2-66-2	106,000	17,000	1,030	GW-050503-DDC-2D-0, 8:55
7/28/05	DDC2-66-2	139,000	16,500	1,410	GW-050728-DDC-2D-0, 9:30
11/2/05	DDC2-66-2	139,000	19,700	1,500	GW-051102-DDC-2D-0, 9:00
2/6/06	DDC2-66-2	128,000	14,300	1,660	GW-060206-DDC-2D-0, 10:50
5/3/06	DDC2-66-2	117,000	33,500	1,540	GW-060503-DDC-2D-0, 9:15
8/7/06	DDC2-66-2	119,000	26,300	1,510	GW-060807-DDC-2D-0, 12:02
11/7/06	DDC2-66-2	99,600	30,600	1,540	GW-061107-DDC-2D-0, 15:15
1/29/07	DDC2-66-2	117,000	44,700	1,960	GW-070129-DDC-2D-0, 14:00
4/30/07	DDC2-66-2	121,000	41,800	1,840	GW-070430-DDC-2D-0, 13:10
8/9/07	DDC2-66-2	63,700	27,300	1,200	GW-070809-DDC-2D-0, 9:58
11/15/07	DDC2-66-2	72,600	60,700	1,530	GW-071115-DDC-2D-0, 10:45
2/5/08	DDC2-66-2	63,100	46,100	1,320	GW-080205-DDC-2D-0, 16:20
5/15/08	DDC2-66-2	66,100	39,600	1,310	GW-080515-DDC-2D-0, 12:50
8/4/08	DDC2-66-2	62,000	26,800	1,120	GW-080804-DDC-2D-0, 15:50
12/19/03	PL2-010A	66,400	210	83	GW-031219-PL2-010A-0, 8:00
9/29/04	PL2-010A	142,000	110	20	GW-040929-PL2-010A-0, 10:55
2/2/06	PL2-010A	102,000	100	316	GW-050202-PL2-010A-0, 9:10
5/5/05	PL2-010A	124,000	130	936	GW-050505-PL2-010A-0, 11:00
7/27/05	PL2-010A	115,000	320	1,170	GW-050727-PL2-010A-1, 16:00
10/31/05	PL2-010A	124,000	880	1,330	GW-051031-PL2-010A-0, 11:15
2/8/06	PL2-010A	124,000	290	1,120	GW-060208-PL2-010A-0, 14:00
5/3/06	PL2-010A	122,000	360	1,310	GW-060503-PL2-010A-0, 10:20
8/7/06	PL2-010A	137,000	1,880	1,450	GW-060807-PL2-010A-0, 13:44
11/7/06	PL2-010A	156,000	2,280	2,000	GW-061107-PL2-010A-0, 15:50
1/30/07	PL2-010A	137,000	940	1,650	GW-070130-PL2-010A-0, 14:15
5/1/07	PL2-010A	153,000	820	1,700	GW-070500-PL2-010A-0, 13:10
8/7/07	PL2-010A	128,000	1,170	2,000	GW-070807-PL2-010A-0, 14:20
11/13/07	PL2-010A	123,000	2,410	2,240	GW-071113-PL2-010A-0, 11:55
11/13/07	PL2-010A (dup)	117,000	2,480	2,110	GW-071113-PL2-010A-1, 11:55
2/6/08	PL2-010A	90,600	1,070	1,370	GW-080206-PL2-010A-0, 9:55
2/6/08	PL2-010A (dup)	83,100	890	1,260	GW-080206-PL2-010A-1, 9:55
5/15/08	PL2-010A	90,400	380	2,150	GW-080515-PL2-010A-0, 11:25
5/15/08	PL2-010A (dup)	90,400	370	2,150	GW-080515-PL2-010A-1, 11:25
8/5/08	PL2-010A	78,900	890	2,130	GW-080805-PL2-010A-0, 10:30
12/18/03	PL2-021A	38,600	9,880	1,050	GW-031218-PL2-021A-0, 11:15
12/18/03	PL2-021A(dup)	45,100	12,000	1,270	GW-031218-PL2-021A-1, 11:15
9/29/04	PL2-021A	167,000	25,900	3,970	GW-040929-PL2-021A-0, 10:05
2/4/05	PL2-021A	192,000	78,700	4,280	GW-050204-PL2-021A-0, 11:15
5/4/05	PL2-021A	229,000	97,000	4,910	GW-050504-PL2-021A-0, 10:30
5/4/05	PL2-021A (dup)	217,000	91,500	4,590	GW-050504-PL2-021A-0, 10:35
7/28/05	PL2-021A	279,000	140,000	6,260	GW-050728-PL2-021A-0, 13:15
7/28/05	PL2-021A (dup)	270,000	137,000	6,120	GW-050728-PL2-021A-1, 13:15
11/2/05	PL2-021A	205,000	21,000	4,770	GW-051102-PL2-021A-0, 12:45
11/2/05	PL2-021A (dup)	200,000	20,600	4,690	GW-051102-PL2-021A-1, 12:50
2/8/06	PL2-021A	187,000	16,300	4,270	GW-060208-PL2-021A-0, 9:00
2/8/06	PL2-021A (dup)	183,000	16,200	4,200	GW-060208-PL2-021A-1, 9:10
5/3/06	PL2-021A	224,000	14,500	5,330	GW-060503-PL2-021A-0, 13:45
5/3/06	PL2-021A (dup)	226,000	14,300	5,350	GW-060503-PL2-021A-1, 13:50
8/8/06	PL2-021A	172,000	24,600	3,940	GW-060807-PL2-021A-0, 11:44
8/8/06	PL2-021A (dup)	171,000	21,800	3,880	GW-060807-PL2-021A-1, 11:44
11/7/06	PL2-021A	194,000	20,900	4,070	GW-061107-PL2-021A-0, 11:20
11/7/06	PL2-021A (dup)	183,000	19,500	3,860	GW-061107-PL2-021A-1, 11:25
1/30/07	PL2-021A	151,000	8,840	3,360	GW-070130-PL2-021A-0, 11:00
1/30/07	PL2-021A (dup)	145,000	8,460	3,340	GW-070129-PL2-021A-1, 11:10
5/1/07	PL2-021A	158,000	26,600	3,280	GW-070501-PL2-021A-0, 8:30
5/1/07	PL2-021A (dup)	150,000	25,700	3,190	GW-070501-PL2-021A-1, 8:35
8/7/07	PL2-021A	128,000	52,500	3,080	GW-070807-PL2-021A-0, 11:40
8/7/07	PL2-021A (dup)	127,000	52,300	3,040	GW-070807-PL2-021A-1, 11:45
11/12/07	PL2-021A	130,000	80,700	2,880	GW-071112-PL2-021A-0, 13:00
2/5/08	PL2-021A	112,000	88,100	2,820	GW-080205-PL2-021A-0, 9:55
5/13/08	PL2-021A	114,000	92,000	2,640	GW-080513-PL2-021A-0, 16:15
8/4/08	PL2-021A	132,000	115,000	3,100	GW-080804-PL2-021A-0, 9:35
8/4/08	PL2-021A (dup)	131,000	113,000	3,070	GW-080804-PL2-021A-1, 9:35
12/18/04	PL2-021B	139,000	27,300	253	GW-031218-PL2-021B-0, 12:30
9/29/04	PL2-021B	20,300	11,400	96	GW-040929-PL2-021B-0, 9:20
2/3/05	PL2-021B	27,600	7,070	44	GW-050203-PL2-021B-0, 11:10
2/3/05	PL2-021B (dup)	28,000	7,130	46	GW-050203-PL2-021B-1, 11:20
5/4/05	PL2-021B	27,200	9,770	63	GW-050504-PL2-021B-0, 11:00
7/28/05	PL2-021B	27,900	11,300	90	GW-050728-PL2-021B-0, 14:00
11/2/05	PL2-021B	35,500	14,900	118	GW-051102-PL2-021B-0, 11:05
2/8/06	PL2-021B	52,700	28,400	327	GW-060208-PL2-021B-0, 10:00
5/3/06	PL2-021B	49,300	19,900	235	GW-060503-PL2-021B-0, 14:30
8/8/06	PL2-021B	20,800	9,910	91	GW-060807-PL2-021B-0, 9:55
11/7/06	PL2-021B	93,400	23,700	390	GW-061107-PL2-021B-0, 12:15
1/30/07	PL2-021B	57,100	25,800	265	GW-070130-PL2-021B-0, 9:40
5/1/07	PL2-021B	25,000	14,100	138	GW-070501-PL2-021B-0, 9:40
8/7/07	PL2-021B	31,200	16,200	253	GW-070807-PL2-021B-0; 10:25
11/12/07	PL2-021B	90,500	28,200	336	GW-071112-PL2-021B-0; 10:25
2/5/08	PL2-021B	67,300	26,400	289	GW-080205-PL2-021B-0; 10:40
5/13/08	PL2-021B	61,800	20,000	252	GW-080513-PL2-021B-0; 15:25
8/4/08	PL2-021B	34,400	14,200	187	GW-080804-PL2-021B-0; 10:59

Notes:  
dup = duplicate sample

NOTE: DDC wells shut-down 8/24/07

Table 4b. Quarterly Performance Monitoring Analytical Results - Geochemical Parameters in Groundwater - Dissolved Metals 2-66 IM DDC System					
Date	Well	Dissolved Metals (µg/L)			Sample ID
		Calcium	Iron	Manganese	
12/18/03	DDC2-66-1	49,000	24,800	1,380	GW-031218-DDC2-66-1-0, 15:15
9/29/04	DDC2-66-1	162,000	113,000	3,670	GW-040929-DDC2-66-1D-0, 7:40
9/29/04	DDC2-66-1 (dup)	161,000	111,000	3,640	GW-040929-DDC2-66-1D-1, 7:45
2/3/05	DDC2-66-1	142,000	79,100	3,090	GW-050203-DDC2-66-1D-1, 10:25
5/3/05	DDC2-66-1	162,000	83,700	3,460	GW-050503-DDC-1D-0, 10:15
7/28/05	DDC2-66-1	211,000	98,300	5,150	GW-050728-DDC-1D-0, 11:00
11/2/05	DDC2-66-1	184,000	110,000	4,800	GW-051102-DDC-1D-0, 10:20
2/6/06	DDC2-66-1	184,000	39,800	4,800	GW-060206-DDC-1D-0, 9:50
5/3/06	DDC2-66-1	164,000	85,500	4,120	GW-060503-DDC-1D-0, 8:15
8/7/06	DDC2-66-1	137,000	71,700	3,340	GW-060807-DDC-1D-0, 10:44
11/7/06	DDC2-66-1	184,000	45,200	4,860	GW-061107-DDC-1D-0, 14:10
1/29/07	DDC2-66-1	159,000	62,500	3,370	GW-070129-DDC-1D-0, 12:25
4/30/07	DDC2-66-1	144,000	74,400	3,710	GW-070430-DDC-1D-0, 11:50
8/8/07	DDC2-66-1	137,000	65,100	3,180	GW-070808-DDC-1D-0, 9:20
11/15/07	DDC2-66-1	167,000	73,500	4,590	GW-071115-DDC-1D-0, 9:35
2/4/08	DDC2-66-1	151,000	85,200	3,780	GW-080204-DDC-1D-0, 15:20
5/15/08	DDC2-66-1	147,000	91,100	3,690	GW-080515-DDC-1D-0, 8:27
8/4/08	DDC2-66-1	120,000	83,700	3,160	GW-080804-DDC-1D-0, 15:06
12/19/03	DDC2-66-2	41,800	80	252	GW-031219-DDC2-66-2-0, 8:45
9/29/04	DDC2-66-2	78,200	11,400	647	GW-040929-DDC2-66-2D-0, 11:35
2/3/05	DDC2-66-2	140,000	79,900	3,080	GW-050203-DDC2-66-2D-0, 9:30
5/3/05	DDC2-66-2	118,000	18,600	1,160	GW-050503-DDC-2D-0, 8:55
7/28/05	DDC2-66-2	142,000	16,800	1,440	GW-050728-DDC-2D-0, 9:30
11/2/05	DDC2-66-2	129,000	18,500	1,430	GW-051102-DDC-2D-0, 9:00
2/6/06	DDC2-66-2	130,000	14,700	1,660	GW-060206-DDC-2D-0, 10:50
5/3/06	DDC2-66-2	116,000	33,200	1,560	GW-060503-DDC-2D-0, 9:15
8/7/06	DDC2-66-2	120,000	26,300	1,500	GW-060807-DDC-2D-0, 12:02
11/7/06	DDC2-66-2	103,000	31,100	1,590	GW-061107-DDC-2D-0, 15:15
1/29/07	DDC2-66-2	119,000	42,900	2,000	GW-070129-DDC-2D-0, 14:00
4/30/07	DDC2-66-2	119,000	38,200	1,760	GW-070430-DDC-2D-0, 13:10
8/9/07	DDC2-66-2	67,600	29,100	1,250	GW-070809-DDC-2D-0, 9:58
11/15/07	DDC2-66-2	73,500	61,600	1,570	GW-071115-DDC-2D-0, 10:45
2/5/08	DDC2-66-2	65,600	47,000	1,370	GW-080205-DDC-2D-0, 16:20
5/15/08	DDC2-66-2	66,300	40,000	1,350	GW-080515-DDC-2D-0, 12:50
8/4/08	DDC2-66-2	61,300	27,000	1,140	GW-080804-DDC-2D-0, 15:50
12/19/03	PL2-010A	67,200	50 U	76	GW-031219-PL2-010A-0, 8:00
9/29/04	PL2-010A	144,000	50 U	11	GW-040929-PL2-010A-0, 10:55
2/2/05	PL2-010A	106,000	50 U	315	GW-050202-PL2-010A-0, 9:10
5/5/05	PL2-010A	140,000	100	1,040	GW-050505-PL2-010A-0, 11:00
7/27/05	PL2-010A	127,000	250	1,290	GW-050727-PL2-010A-1, 16:00
10/31/05	PL2-010A	123,000	290	1,280	GW-051031-PL2-010A-0, 11:15
2/8/06	PL2-010A	124,000	90	1,100	GW-060208-PL2-010A-0, 14:00
5/3/06	PL2-010A	119,000	200	1,290	GW-060503-PL2-010A-0, 10:20
8/7/06	PL2-010A	139,000	1,460	1,440	GW-060807-PL2-010A-0, 13:44
11/7/06	PL2-010A	157,000	2,010	2,020	GW-061107-PL2-010A-0, 15:50
1/30/07	PL2-010A	138,000	680	1,640	GW-070130-PL2-010A-0, 14:15
5/1/07	PL2-010A	152,000	700	1,740	GW-070501-PL2-010A-0, 13:10
8/7/07	PL2-010A	158,000	1,170	2,220	GW-070807-PL2-010A-0, 14:20
11/13/07	PL2-010A	123,000	2,080	2,210	GW-071113-PL2-010A-0, 11:55
11/13/07	PL2-010A (dup)	123,000	1,960	2,210	GW-071113-PL2-010A-1, 11:55
2/6/08	PL2-010A	90,300	1,080	1,400	GW-080206-PL2-010A-0, 9:55
2/6/08	PL2-010A (dup)	90,400	1,010	1,400	GW-080206-PL2-010A-1, 9:55
5/15/08	PL2-010A	91,100	390	2,260	GW-080515-PL2-010A-0, 11:25
5/15/08	PL2-010A (dup)	91,200	390	2,270	GW-080515-PL2-010A-1, 11:25
8/5/08	PL2-010A	78,600	910	2,060	GW-080805-PL2-010A-0, 10:30
12/18/03	PL2-021A	42,600	10,900	1,210	GW-031218-PL2-021A-0, 11:15
12/18/03	PL2-021A(dup)	42,200	11,100	1,200	GW-031218-PL2-021A-1, 11:15
9/29/04	PL2-021A	169,000	22,200	4,050	GW-040929-PL2-021A-0, 10:05
2/4/05	PL2-021A	198,000	83,500	4,440	GW-050204-PL2-021A-0, 11:15
5/4/05	PL2-021A	232,000	101,000	5,110	GW-050504-PL2-021A-0, 10:30
5/4/05	PL2-021A (dup)	233,000	97,800	5,110	GW-050504-PL2-021A-0, 10:35
7/28/05	PL2-021A	280,000	147,000	6,500	GW-050728-PL2-021A-0, 13:15
7/28/05	PL2-021A (dup)	283,000	146,000	6,340	GW-050728-PL2-021A-1, 13:15
11/2/05	PL2-021A	206,000	21,900	4,860	GW-051102-PL2-021A-0, 12:45
11/2/05	PL2-021A (dup)	214,000	23,200	5,160	GW-051102-PL2-021A-1, 12:50
2/8/06	PL2-021A	186,000	15,700	4,190	GW-060208-PL2-021A-0, 9:00
2/8/06	PL2-021A (dup)	185,000	15,700	4,180	GW-060208-PL2-021A-1, 9:10
5/3/06	PL2-021A	232,000	14,300	5,530	GW-060503-PL2-021A-0, 13:45
5/3/06	PL2-021A (dup)	228,000	14,400	5,480	GW-060503-PL2-021A-1, 13:50
8/8/06	PL2-021A	169,000	23,600	3,870	GW-060807-PL2-021A-0, 11:44
8/8/06	PL2-021A (dup)	162,000	24,100	3,790	GW-060807-PL2-021A-1, 11:44
11/7/06	PL2-021A	189,000	21,000	4,070	GW-061107-PL2-021A-0, 11:20
11/7/06	PL2-021A (dup)	191,000	20,800	4,060	GW-061107-PL2-021A-1, 11:25
1/30/07	PL2-021A	157,000	8,860	3,410	GW-070130-PL2-021A-0, 11:00
1/30/07	PL2-021A (dup)	160,000	9,030	3,480	GW-070130-PL2-021A-1, 11:10
5/1/07	PL2-021A	153,000	27,100	3,270	GW-070501-PL2-021A-0, 8:30
5/1/07	PL2-021A (dup)	156,000	27,700	3,280	GW-070501-PL2-021A-1, 8:35
8/7/07	PL2-021A	145,000	58,900	3,230	GW-070807-PL2-021A-0, 11:40
8/7/07	PL2-021A (dup)	137,000	57,200	3,180	GW-070807-PL2-021A-1, 11:45
11/12/07	PL2-021A	128,000	81,100	3,000	GW-071112-PL2-021A-0, 13:00
2/5/08	PL2-021A	115,000	91,100	2,820	GW-080205-PL2-021A-0, 9:55
5/13/08	PL2-021A	117,000	93,400	2,660	GW-080513-PL2-021A-0, 16:15
8/4/08	PL2-021A	132,000	114,000	3,050	GW-080804-PL2-021A-0, 9:35
8/4/08	PL2-021A (dup)	136,000	113,000	3,010	GW-080804-PL2-021A-1, 9:35
12/18/03	PL2-021B	134,000	26,000	237	GW-031218-PL2-021B-0, 12:30
9/29/04	PL2-021B	19,800	760	87	GW-040929-PL2-021B-0, 9:20
2/3/05	PL2-021B	50,600	12,800	129	GW-050203-PL2-021B-0, 11:10
2/3/05	PL2-021B (dup)	32,200	7,330	55	GW-050203-PL2-021B-1, 11:20
5/4/05	PL2-021B	28,300	9,530	72	GW-050504-PL2-021B-0, 11:00
7/28/05	PL2-021B	27,600	11,200	93	GW-050728-PL2-021B-0, 14:00
11/2/05	PL2-021B	72,400	15,600	117	GW-051102-PL2-021B-0, 11:05
2/8/06	PL2-021B	63,700	27,100	329	GW-060208-PL2-021B-0, 10:00
5/3/06	PL2-021B	47,200	17,200	233	GW-060503-PL2-021B-0, 14:30
8/8/06	PL2-021B	27,100	10,800	125	GW-060807-PL2-021B-0, 9:55
11/7/06	PL2-021B	93,000	23,600	395	GW-061107-PL2-021B-0, 12:15
1/30/07	PL2-021B	104,000	25,100	397	GW-070130-PL2-021B-0, 9:40
5/1/07	PL2-021B	30,600	3,180	181	GW-070501-PL2-021B-0, 9:40
8/7/07	PL2-021B	34,100	16,600	240	GW-070807-PL2-021B-0, 10:25
11/12/07	PL2-021B	83,000	19,100	346	GW-071112-PL2-021B-0, 10:25
2/5/08	PL2-021B	75,700	25,800	329	GW-080205-PL2-021B-0, 10:40
5/13/08	PL2-021B	62,300	18,900	251	GW-080513-PL2-021B-0, 15:25
8/4/08	PL2-021B	36,000	12,300	186	GW-080804-PL2-021B-0,10:59

Notes:  
 U = non-detect, result below indicated detection limit  
 dup = duplicate sample

NOTE: DDC wells shut-down 8/24/07

Table 4c. Quarterly Performance Monitoring Analytical Results - Geochemical Parameters in Groundwater - Alkalinity 2-66 IM DDC System					
Date	Well	Alkalinity (mg/L)			Sample ID
		Total	Carbonate	Bicarbonate	
12/18/03	DDC2-66-1	170	1 U	170	GW-031218-DDC2-66-1-0, 15:15
9/29/04	DDC2-66-1	1 U	1 U	1 U	GW-040929-DDC2-66-1D-0, 7:40
9/29/04	DDC2-66-1(dup)	1 U	1 U	1 U	GW-040929-DDC2-66-1D-1, 7:45
2/3/05	DDC2-66-1	134	1 U	134	GW-050203-DDC2-66-1D-1, 10:25
5/3/05	DDC2-66-1	117	1 U	117	GW-050503-DDC-1D-0, 10:15
7/28/05	DDC2-66-1	74.4	1 U	74.4	GW-050728-DDC-1D-0, 11:00
11/2/05	DDC2-66-1	36.3	1 U	36.3	GW-051102-DDC-1D-0, 10:20
2/6/06	DDC2-66-1	1 U	1 U	1 U	GW-060206-DDC-1D-0, 9:50
5/3/06	DDC2-66-1	41.8	1 U	41.8	GW-060503-DDC-1D-0, 8:15
8/7/06	DDC2-66-1	ND	ND	ND	GW-060807-DDC-1D-0, 10:44
11/7/06	DDC2-66-1	1 U	1 U	1 U	GW-061107-DDC-1D-0, 14:10
1/29/07	DDC2-66-1	2.7	1 U	2.7	GW-070129-DDC-1D-0, 12:25
4/30/07	DDC2-66-1	79.3	1 U	79.3	GW-070430-DDC-1D-0, 11:50
8/8/07	DDC2-66-1	14.5	1 U	14.5	GW-070808-DDC-1D-0, 9:20
11/15/07	DDC2-66-1	5.7	1 U	5.7	GW-071115-DDC-1D-0, 9:35
2/4/08	DDC2-66-1	8.6	1 U	8.6	GW-080204-DDC-1D-0, 15:20
5/15/08	DDC2-66-1	8.4	1 U	8.4	GW-080515-DDC-1D-0, 8:27
8/4/08	DDC2-66-1	15.2	1 U	15.2	GW-080804-DDC-1D-0, 15:06
12/19/03	DDC2-66-2	82	1 U	82	GW-031219-DDC2-2-0, 8:45
9/29/04	DDC2-66-2	1 U	1 U	1 U	GW-040929-DDC2-66-2D-0, 11:35
2/3/05	DDC2-66-2	135	1 U	135	GW-050203-DDC2-66-2D-0, 9:30
5/3/05	DDC2-66-2	11.2	1 U	11.2	GW-050503-DDC-2D-0, 8:55
7/28/05	DDC2-66-2	4.1	1 U	4.1	GW-050728-DDC-2D-0, 9:30
11/2/05	DDC2-66-2	3.1	1 U	3.1	GW-051102-DDC-2D-0, 9:00
2/6/06	DDC2-66-2	1.7	1 U	1.7	GW-060206-DDC-2D-0, 10:50
5/3/06	DDC2-66-2	46.2	1 U	46.2	GW-060503-DDC-2D-0, 9:15
8/7/06	DDC2-66-2	ND	ND	ND	GW-060807-DDC-2D-0, 12:02
11/7/06	DDC2-66-2	1 U	1 U	1 U	GW-061107-DDC-2D-0, 15:15
1/29/07	DDC2-66-2	65.0	1 U	65.0	GW-070129-DDC-2D-0, 14:00
4/30/07	DDC2-66-2	11.8	1 U	11.8	GW-070430-DDC-2D-0, 13:10
8/9/07	DDC2-66-2	11.0	1 U	11.0	GW-070809-DDC-2D-0, 9:58
11/15/07	DDC2-66-2	1 U	1 U	1 U	GW-071115-DDC-2D-0, 10:45
2/5/08	DDC2-66-2	2.6	1 U	2.6	GW-080205-DDC-2D-0, 16:20
5/15/08	DDC2-66-2	1 U	1 U	1 U	GW-080515-DDC-2D-0, 12:50
8/4/08	DDC2-66-2	1 U	1 U	1 U	GW-080804-DDC-2D-0, 15:50
12/19/03	PL2-010A	230	1 U	230	GW-031219-PL2-010A-0, 8:00
9/29/04	PL2-010A	11.4	1 U	11.4	GW-040929-PL2-010A-0, 10:55
2/2/05	PL2-010A	2.8	1 U	2.8	GW-050202-PL2-010A-0, 9:10
5/5/05	PL2-010A	1 U	1 U	1 U	GW-050505-PL2-010A-0, 11:00
7/28/05	PL2-010A	1 U	1 U	1 U	GW-050728-PL2-010A-0, 10:20
10/31/05	PL2-010A	1 U	1 U	1 U	GW-051031-PL2-010A-0, 11:15
2/8/06	PL2-010A	1 U	1 U	1 U	GW-060208-PL2-010A-0, 14:00
5/3/06	PL2-010A	1 U	1 U	1 U	GW-060503-PL2-010A-0, 10:20
8/7/06	PL2-010A	ND	ND	ND	GW-060807-PL2-010A-0, 13:44
11/7/06	PL2-010A	1 U	1 U	1 U	GW-061107-PL2-010A-0, 15:50
1/30/07	PL2-010A	1 U	1 U	1 U	GW-070130-PL2-010A-0, 14:15
5/1/07	PL2-010A	1 U	1 U	1 U	GW-070501-PL2-010A-0, 13:10
8/7/07	PL2-010A	1 U	1 U	1 U	GW-070807-PL2-010A-0, 14:20
11/13/07	PL2-010A	1 U	1 U	1 U	GW-071113-PL2-010A-0, 11:55
11/13/07	PL2-010A (dup)	1 U	1 U	1 U	GW-071113-PL2-010A-1, 11:55
2/6/08	PL2-010A	1 U	1 U	1 U	GW-080206-PL2-010A-0, 9:55
2/6/08	PL2-010A (dup)	1 U	1 U	1 U	GW-080206-PL2-010A-1, 9:55
5/15/08	PL2-010A	1 U	1 U	1 U	GW-080515-PL2-010A-0, 11:25
5/15/08	PL2-010A (dup)	1 U	1 U	1 U	GW-080515-PL2-010A-1, 11:25
8/5/08	PL2-010A	1 U	1 U	1 U	GW-080805-PL2-010A-0, 10:30
12/18/03	PL2-021A	150	1 U	150	GW-031218-PL2-021A-0, 11:15
12/18/03	PL2-021A(dup)	160	1 U	160	GW-031218-PL2-021A-1, 11:15
9/29/04	PL2-021A	1 U	1 U	1 U	GW-040929-PL2-021A-0, 10:05
2/4/05	PL2-021A	1 U	1 U	1 U	GW-050204-PL2-021A-0, 11:15
5/4/05	PL2-021A	1 U	1 U	1 U	GW-050504-PL2-021A-0, 10:30
5/4/05	PL2-021A (dup)	1 U	1 U	1 U	GW-050504-PL2-021A-1, 10:35
7/28/05	PL2-021A	1 U	1 U	1 U	GW-050728-PL2-021A-0, 13:15
7/28/05	PL2-021A (dup)	1 U	1 U	1 U	GW-050728-PL2-021A-1, 13:15
11/2/05	PL2-021A	1 U	1 U	1 U	GW-051102-PL2-021A-0, 12:45
11/2/05	PL2-021A (dup)	1 U	1 U	1 U	GW-051102-PL2-021A-1, 12:50
2/8/06	PL2-021A	1 U	1 U	1 U	GW-060208-PL2-021A-0, 9:00
2/8/06	PL2-021A (dup)	1 U	1 U	1 U	GW-060208-PL2-021A-1, 9:10
5/3/06	PL2-021A	1 U	1 U	1 U	GW-060503-PL2-021A-0, 13:45
5/3/06	PL2-021A (dup)	1 U	1 U	1 U	GW-060503-PL2-021A-1, 13:50
8/8/06	PL2-021A	ND	ND	ND	GW-060807-PL2-021A-0, 11:44
8/8/06	PL2-021A (dup)	ND	ND	ND	GW-060807-PL2-021A-1, 11:44
11/7/06	PL2-021A	1 U	1 U	1 U	GW-061107-PL2-021A-0, 11:20
11/7/06	PL2-021A (dup)	1 U	1 U	1 U	GW-061107-PL2-021A-1, 11:25
1/30/07	PL2-021A	1 U	1 U	1 U	GW-070130-PL2-021A-0, 11:00
1/30/07	PL2-021A (dup)	1 U	1 U	1 U	GW-070130-PL2-021A-1, 11:10
5/1/07	PL2-021A	1 U	1 U	1 U	GW-070501-PL2-021A-0, 8:30
5/1/07	PL2-021A (dup)	1 U	1 U	1 U	GW-070501-PL2-021A-1, 8:35
8/7/07	PL2-021A	1 U	1 U	1 U	GW-070807-PL2-021A-0, 11:40
8/7/07	PL2-021A (dup)	1 U	1 U	1 U	GW-070807-PL2-021A-1, 11:45
11/12/07	PL2-021A	1 U	1 U	1 U	GW-071112-PL2-021A-0, 13:00
2/5/08	PL2-021A	1 U	1 U	1 U	GW-080205-PL2-021A-0, 9:55
5/13/08	PL2-021A	1 U	1 U	1 U	GW-080513-PL2-021A-0, 16:15
8/4/08	PL2-021A	1 U	1 U	1 U	GW-080804-PL2-021A-0, 9:35
8/4/08	PL2-021A (dup)	1 U	1 U	1 U	GW-080804-PL2-021A-1, 9:35
12/18/03	PL2-021B	95	1 U	95	GW-031218-PL2-021B-0, 12:30
9/29/04	PL2-021B	69	1 U	69	GW-040929-PL2-021B-0, 9:20
2/3/05	PL2-021B	119	1 U	119	GW-050203-PL2-021B-0, 11:10
2/3/05	PL2-021B (dup)	119	1 U	119	GW-050203-PL2-021B-1, 11:20
5/4/05	PL2-021B	160	1 U	160	GW-050504-PL2-021B-0, 11:00
7/28/05	PL2-021B	164	1 U	164	GW-050728-PL2-021B-0, 14:00
11/2/05	PL2-021B	110	1 U	110	GW-051102-PL2-021B-0, 11:05
2/8/06	PL2-021B	150	1 U	150	GW-060208-PL2-021B-0, 10:00
5/3/06	PL2-021B	218	1 U	218	GW-060503-PL2-021B-0, 14:30
8/8/06	PL2-021B	ND	ND	ND	GW-060807-PL2-021B-0, 9:55
11/7/06	PL2-021B	84.5	1 U	84.5	GW-061107-PL2-021B-0, 12:15
1/30/07	PL2-021B	118	1 U	118	GW-070130-PL2-021B-0, 9:40
5/1/07	PL2-021B	163	1 U	163	GW-070501-PL2-021B-0, 9:40
8/7/07	PL2-021B	208	1 U	208	GW-070807-PL2-021B-0, 10:25
11/12/07	PL2-021B	71.9	1 U	71.9	GW-071112-PL2-021B-0, 10:25
2/5/08	PL2-021B	104	1 U	104	GW-080205-PL2-021B-0, 10:40
5/13/08	PL2-021B	112	1 U	112	GW-080513-PL2-021B-0,15:25
8/4/08	PL2-021B	147	1 U	147	GW-080804-PL2-021B-0, 10:59

Notes:  
 U = non-detect, result below indicated detection limit  
 dup = duplicate sample

ND = no data  
 NOTE: DDC wells shut-down 8/24/07

**Table 5. Quarterly Performance Monitoring Analytical Results -  
Low-Level Mercury (Total) in Groundwater (16th Quarter)  
2-66 IM DDC System**

Date	Well	Low-Level Mercury (ng/L) (Method SW7470A)	Sample ID
8/6/08	PL2-007AR	20.0 U	GW-080806-PL2-007AR-0
8/6/08	PL2-041AA(008A)	20.0 U	GW-080806-PL2-041AA-0
8/6/08	PL2-008B	20.0 U	GW-080806-PL2-008B-0
8/7/08	PL2-008C	30.3	GW-080806-PL2-008C-0
8/5/08	PL2-010A	20.0 U	GW-080805-PL2-010A-0
8/6/08	PL2-017A	20.0 U	GW-080806-PL2-017A-0
8/4/08	PL2-021A	20.0 U	GW-080804-PL2-021A-0
8/4/08	PL2-021A (dup)	20.0 U	GW-080804-PL2-021A-1
8/4/08	PL2-021B	20.0 U	GW-080804-PL2-021B-0
8/4/08	PL2-021C	20.0 U	GW-080804-PL2-021C-0
8/3/08	PL2-030A	20.0 U	GW-080803-PL2-030A-0
8/3/08	PL2-030C	20.0 U	GW-080803-PL2-030C-0
8/5/08	PL2-031A	20.0 U	GW-080805-PL2-031A-0
8/4/08	PL2-032A	20.0 U	GW-080804-PL2-032A-0
8/5/08	PL2-034A	20.0 U	GW-080805-PL2-034A-0
8/5/08	PL2-035A	20.0 U	GW-080805-PL2-035A-0
8/5/08	PL2-035A (dup)	20.0 U	GW-0808050PL2-035A-1
8/3/08	PL2-043B	20.0 U	GW-080803-PL2-043B-0
8/3/08	PL2-044B	20.0 U	GW-080803-PL2-044B-0
8/4/08	PL2-JF01AR	20.0 U	GW-080804-PL2-JF01AR-0
8/4/08	PL2-JF01B	20.0 U	GW-080804-PL2-JF01B-0
8/4/08	PL2-JF01C	20.0 U	GW-080804-PL2-JF01C-0
8/4/08	PP-1B-I	20.0 U	GW-080804-PP-1B-I-0
8/4/08	PP-1B-O	20.0 U	GW-080804-PP-1B-O-0
8/5/08	PP-2B-I	20.0 U	GW-080805-PP-2B-I-0
8/5/08	PP-2B-O	20.0 U	GW-080805-PP-2B-O-0
8/5/08	PP-3A-I	20.0 U	GW-080805-PP-3A-I-0
8/5/08	PP-3B-I	20.0 U	GW-080805-PP-3B-I-0
8/5/08	PP-3C-I	20.0 U	GW-080805-PP-3C-I-0
8/6/08	PP-4B-I	20.0 U	GW-080806-PP-4B-I-0
8/6/08	PP-4B-O	20.0 U	GW-080806-PP-4B-O-0
8/6/08	PP-5B-I	20.0 U	GW-080806-PP-5B-I-0
8/6/08	PP-5B-O	20.0 U	GW-080806-PP-5B-O-0

**Notes:**

ng/L = nanograms per liter

U = non-detect, result below indicated detection limit

dup = duplicate sample

ND = no data

NOTE: DDC wells shut-down 8/24/07

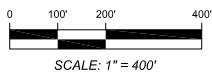
## Figures



KEY:



- 2-66 BUILDING
- 2-66R BUILDING REMOVED
- PLANT 2 BOUNDARY
- SHEETPILE CONTAINMENT STRUCTURE



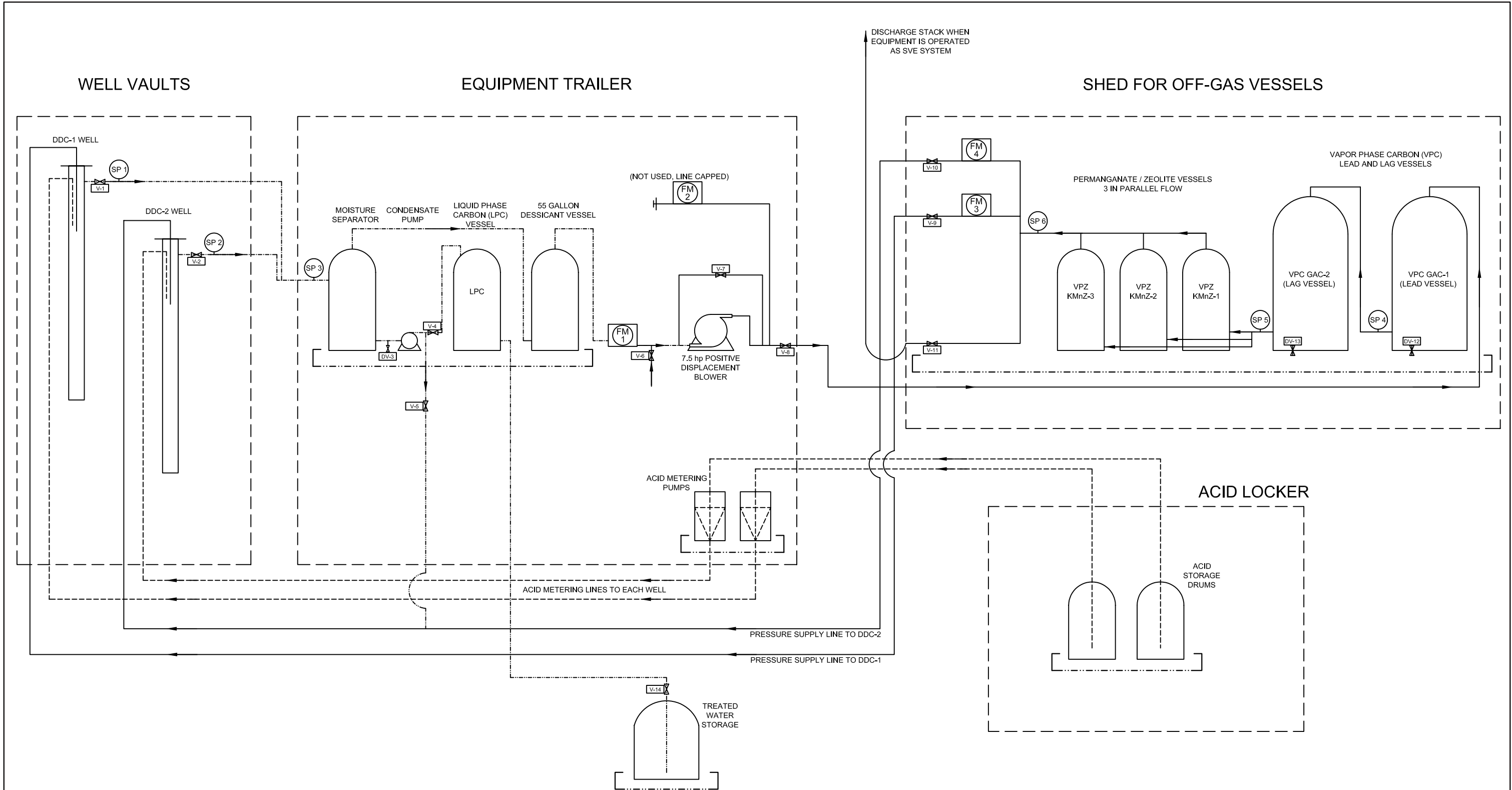
**ENVIRONMENTAL  
PARTNERS INC**

295 NE Gilman Boulevard, Suite 201  
Issaquah, Washington 98027

FIGURE 1


SITE LOCATION MAP


PROJECT	BUILDING 2-66 SHEETPILE & DDC IM QUARTERLY REPORT		
	THE BOEING COMPANY		
LOCATION	BOEING PLANT 2 SEATTLE / TUKWILA, WASHINGTON		
SHEET 1 of 1	DRAWN BY TJN	REVIEWED BY JD	DATE 02/14/05




KEY:

 VENTURI FLOW METER

 VALVE ID

 VAPOR SAMPLING PORT ID

 VACUUM AIR LINES (2 INCH TYP.)

 PRESSURE AIR LINES (2 OR 3 INCH TYP.)

 ACID METERING LINE (1/4 INCH KYNAR TUBING, INSIDE 1.5 INCH PVC TUBING)

 HOSE FOR LIQUIDS (1 INCH TYP.)

 SECONDARY CONTAINMENT



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FIGURE 2

SCHEMATIC DIAGRAM OF EQUIPMENT TRAILER  
AND TREATMENT SHED

PROJECT

BUILDING 2-66 SHEETPILE & DDC  
IM QUARTERLY REPORT

PREPARED  
FOR

THE BOEING COMPANY

LOCATION

BOEING PLANT 2  
SEATTLE / TUKWILA, WASHINGTON

SHEET  
1 of 1

DRAWN BY  
TK

REVIEWED BY  
JD

DATE  
02/14/05

# DUWAMISH WATERWAY

APPROXIMATE SITE BOUNDARY

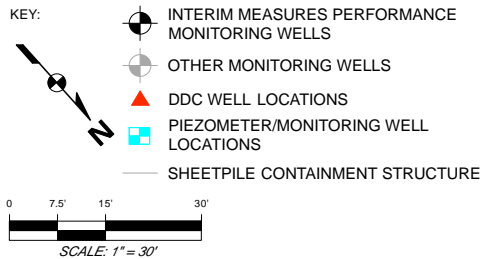
CONTAINMENT STRUCTURE

INSIDE  
CONTAINMENT  
STRUCTURE

FORMER 2-66 BUILDING  
PL2-019A

FORMER 2-108 BUILDING

APPROXIMATE GROUNDWATER  
FLOW DIRECTION

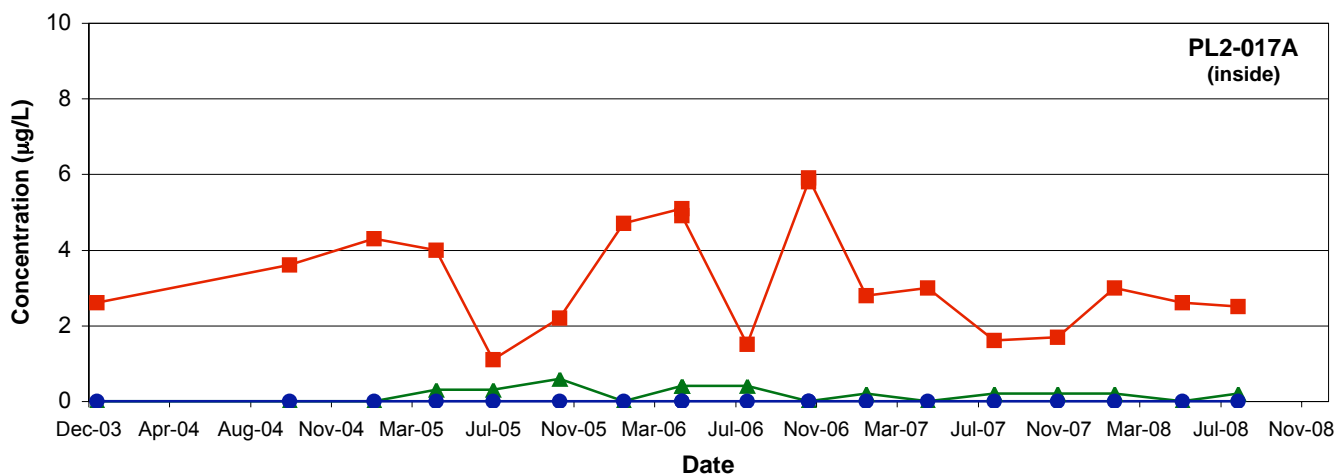
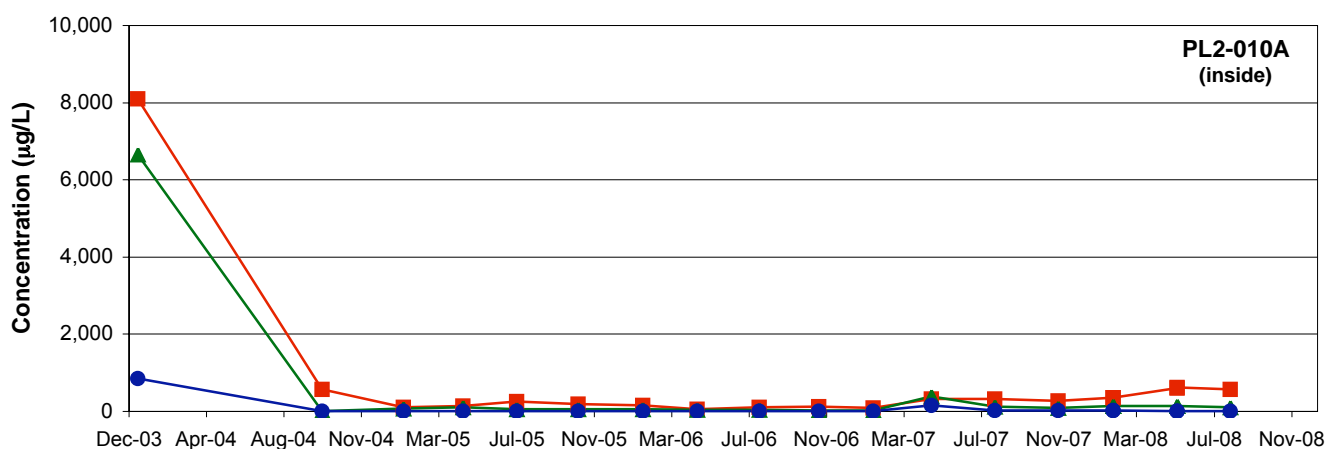
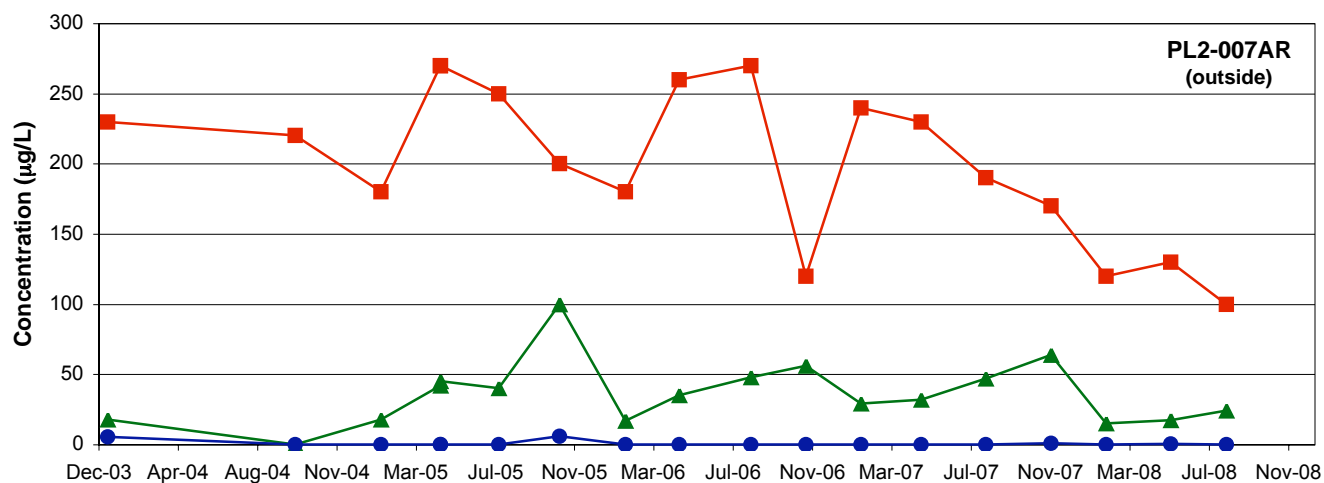


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Issaquah, Washington 98027

FIGURE 3

BUILDING 2-66 INTERIM MEASURES  
PERFORMANCE MONITORING WELL NETWORK

<b>PROJECT</b>	BUILDING 2-66 SHEETPILE & DDC IM QUARTERLY REPORT		
<b>PREPARED FOR</b>	THE BOEING COMPANY		
<b>LOCATION</b>	BOEING PLANT 2 SEATTLE / TUKWILA, WA		
<b>SHEET</b>	<b>DRAWN BY</b>	<b>REVIEWED BY</b>	<b>DATE</b>
1 of 1	ARM	JD	07/14/08



Legend

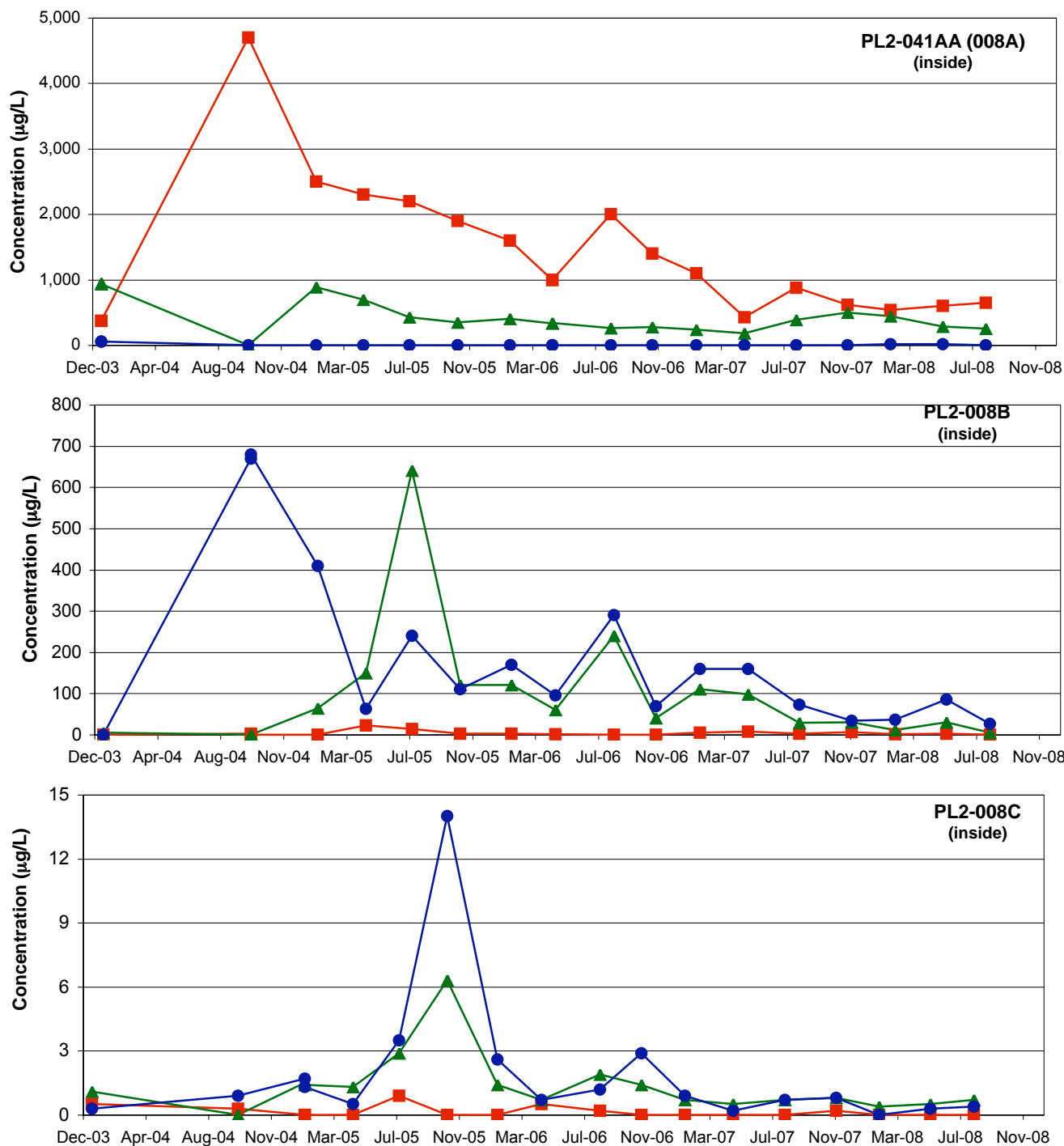
- Trichloroethene (µg/L)
- ▲— cis-1,2-Dichloroethene (µg/L)
- Vinyl Chloride (µg/L)



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FIGURE 4a  
CHLORINATED VOC TRENDS AT  
PL2-007AR, PL2-010A, AND PL2-017A  
(see Table 4 for aggregate results)

Project	Boeing Plant 2		
Prepared For	The Boeing Company		
Location	7725 East Marginal Way Seattle/Tukwila, Washington		
	Drawn By JEB	Reviewed By JLD	Date 12/30/08



Legend

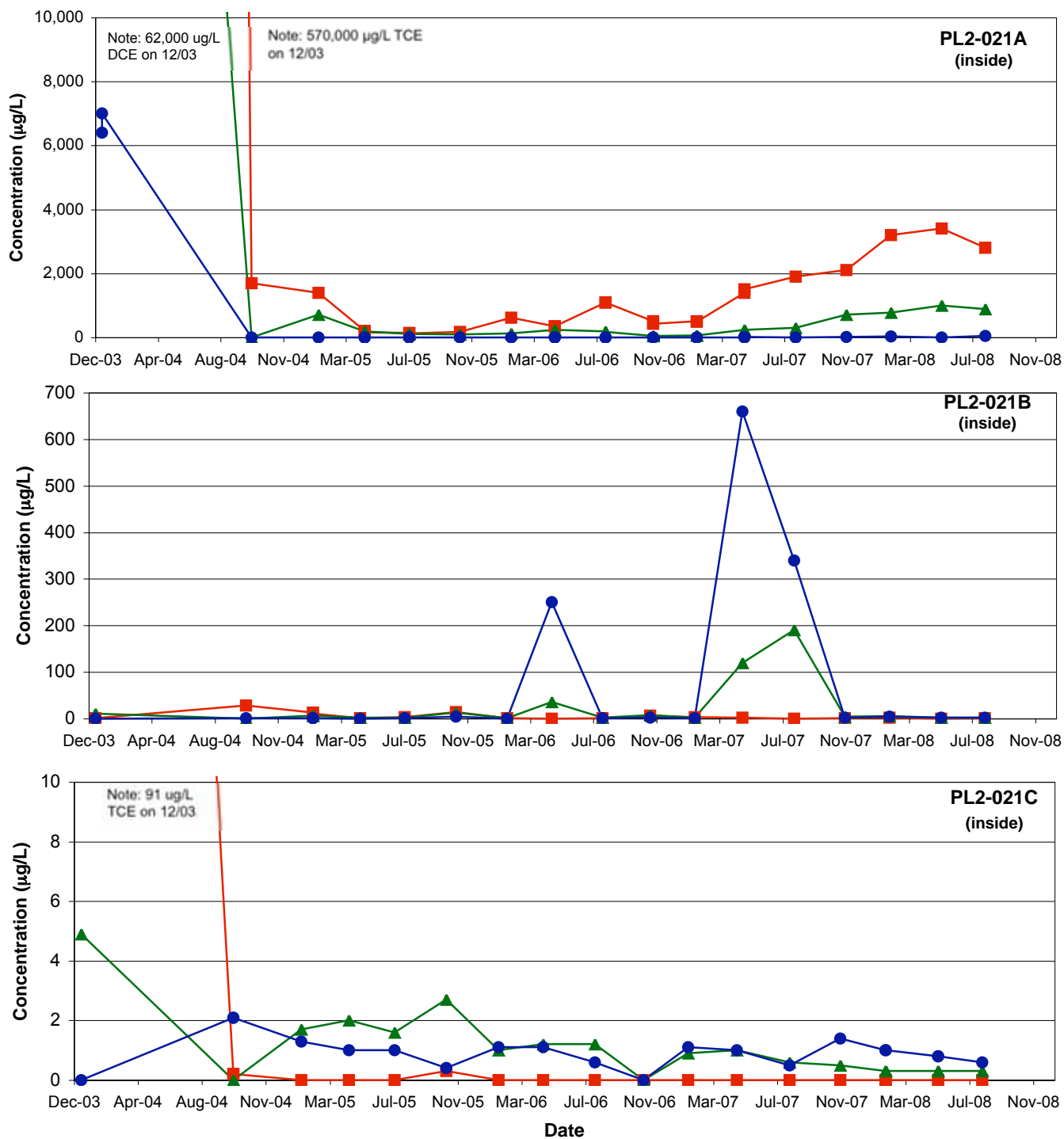
- Trichloroethene (µg/L)
- cis-1,2-Dichloroethene (µg/L)
- Vinyl Chloride (µg/L)



**ENVIRONMENTAL  
PARTNERS INC**

**FIGURE 4b**  
**CHLORINATED VOC TRENDS AT**  
**PL2-041AA, PL2-008B, and PL2-008C**  
(see Table 4 for aggregate results)

Project	Boeing Plant 2		
Prepared For	The Boeing Company		
Location	7725 East Marginal Way Seattle/Tukwila, Washington		
	Drawn By JEB	Reviewed By JLD	Date 12/30/08



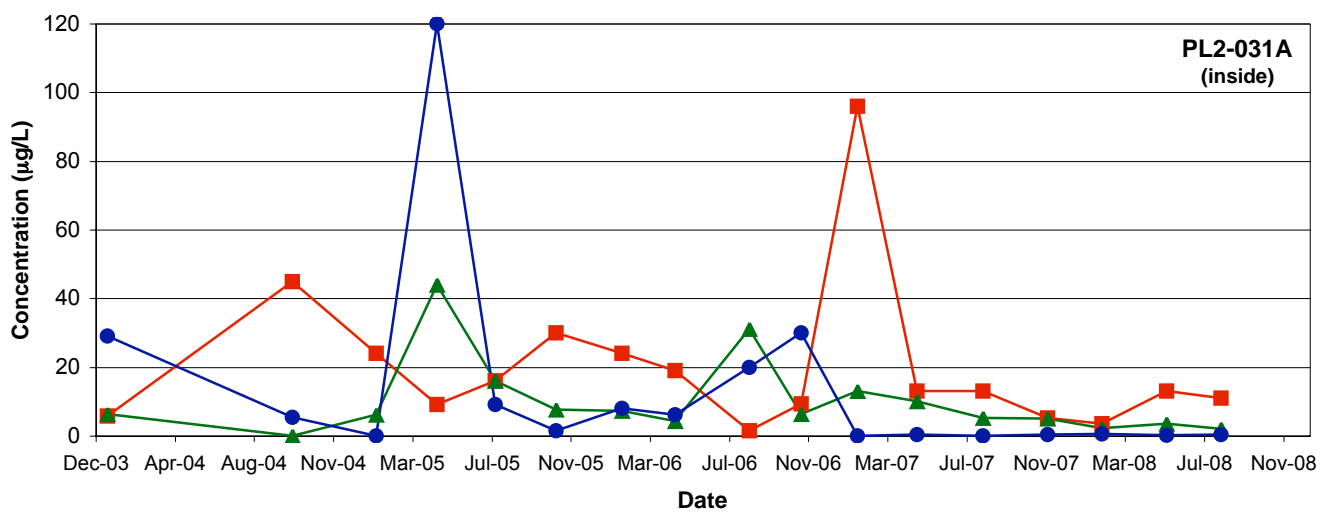
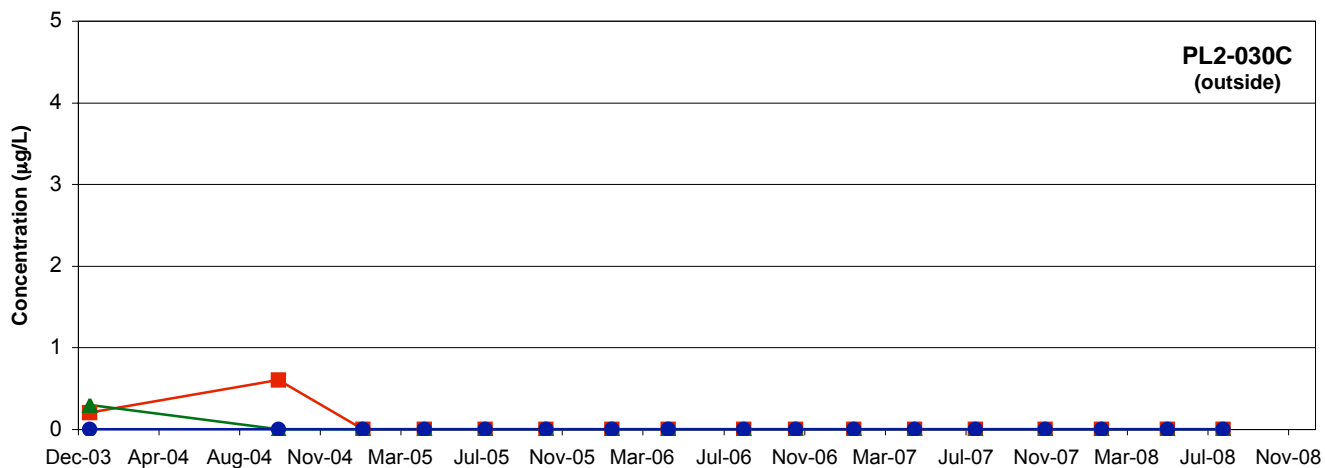
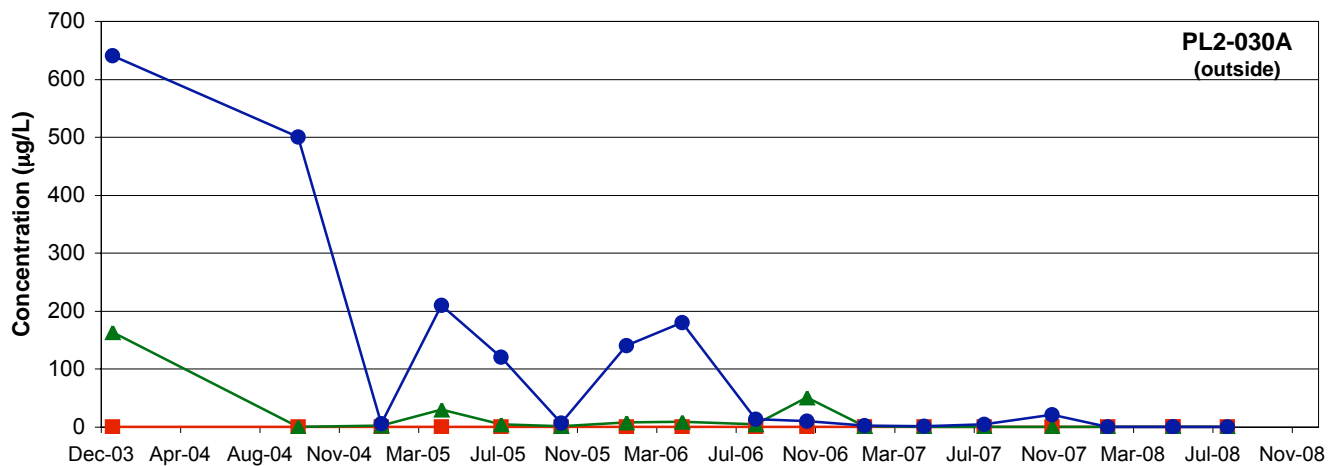
Legend

- Trichloroethene (µg/L)
- cis-1,2-Dichloroethene (µg/L)
- Vinyl Chloride (µg/L)



FIGURE 4c  
CHLORINATED VOC TRENDS AT  
PL2-021A, PL2-021B, AND PL2-021C  
(see Table 4 for aggregate results)

Project	Boeing Plant 2		
Prepared For	The Boeing Company		
Location	7725 East Marginal Way Seattle/Tukwila, Washington		
	Drawn By JEB	Reviewed By JLD	Date 12/30/08



Legend

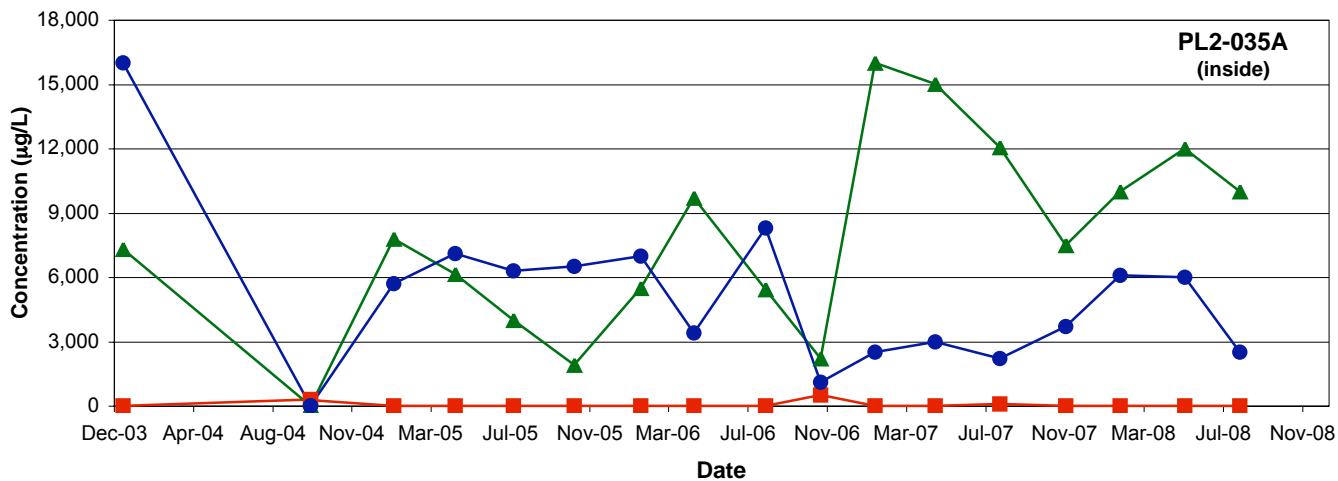
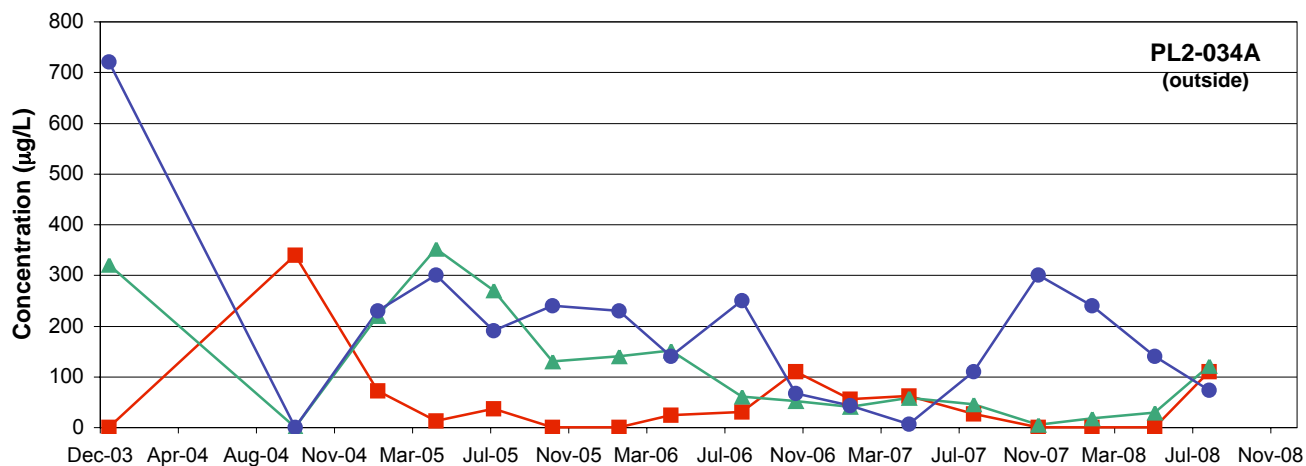
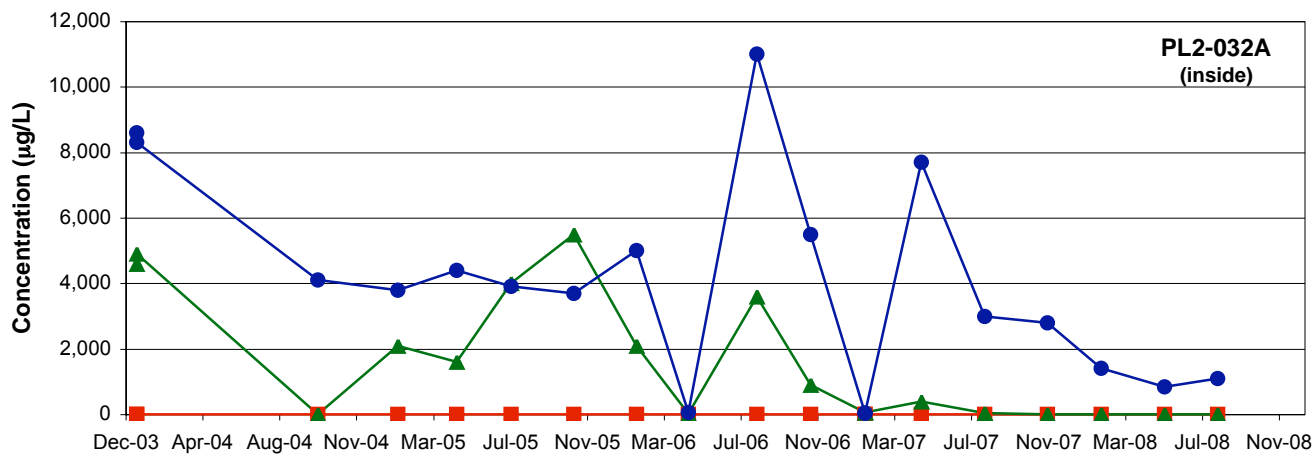
- Trichloroethene (µg/L)
- ▲— cis-1,2-Dichloroethene (µg/L)
- Vinyl Chloride (µg/L)



**ENVIRONMENTAL  
PARTNERS INC**

FIGURE 4d  
CHLORINATED VOC TRENDS AT  
PL2-030A, PL2-030C, AND PL2-031A  
(see Table 4 for aggregate results)

Project	Boeing Plant 2		
Prepared For	The Boeing Company		
Location	7725 East Marginal Way Seattle/Tukwila, Washington		
Drawn By	Reviewed By	Date	
JEB	JLD	12/30/08	



Legend

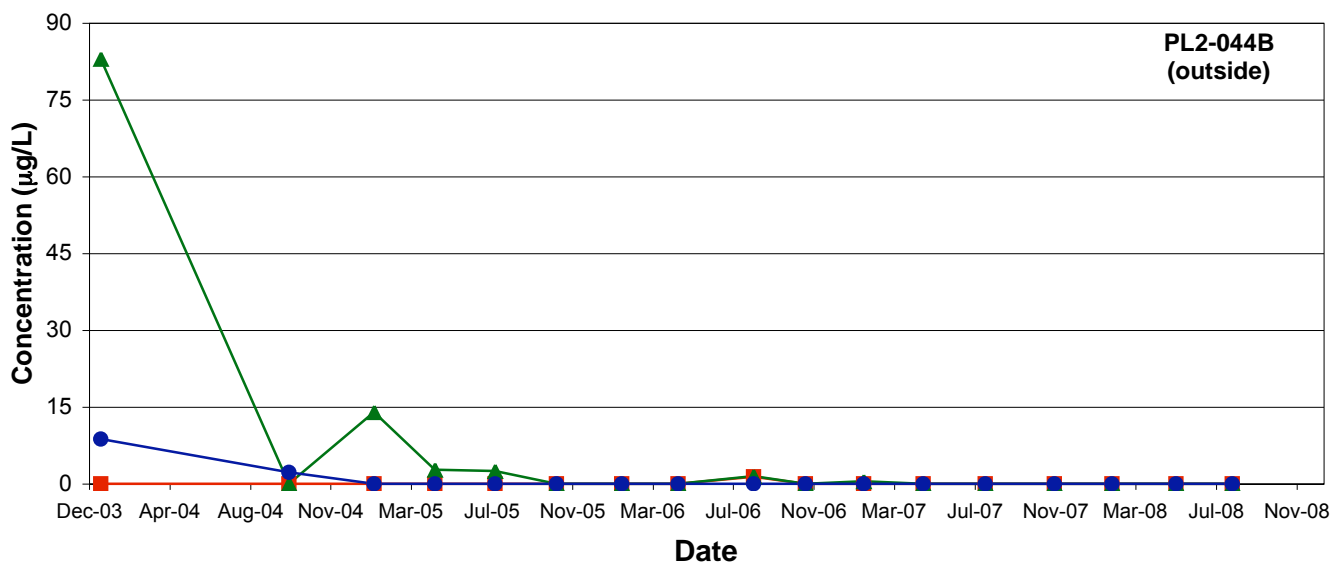
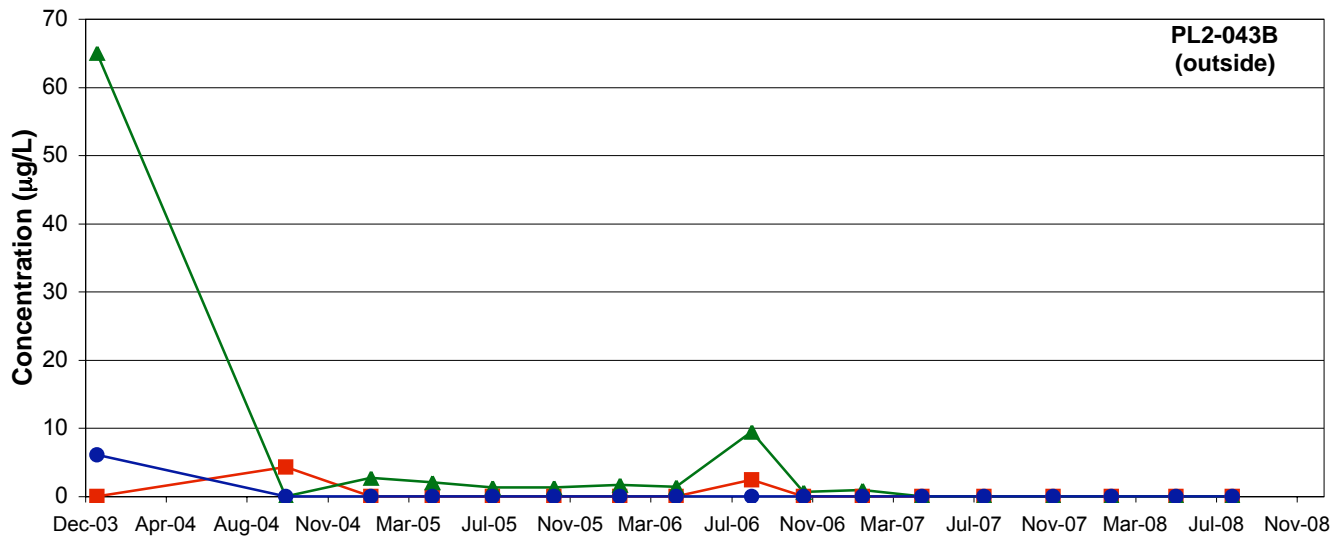
- Trichloroethene (µg/L)
- cis-1,2-Dichloroethene (µg/L)
- Vinyl Chloride (µg/L)



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**FIGURE 4e**  
CHLORINATED VOC TRENDS AT  
PL2-032A, PL2-034A, AND PL2-035A  
(see Table 4 for aggregate results)

Project	Boeing Plant 2		
Prepared For	The Boeing Company		
Location	7725 East Marginal Way Seattle/Tukwila, Washington		
	Drawn By JEB	Reviewed By JLD	Date 12/30/08



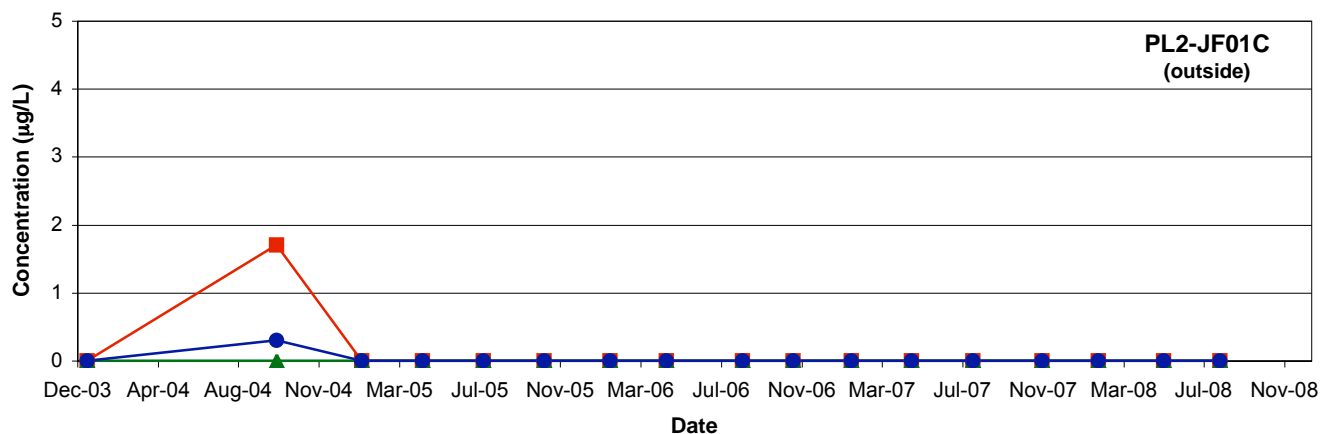
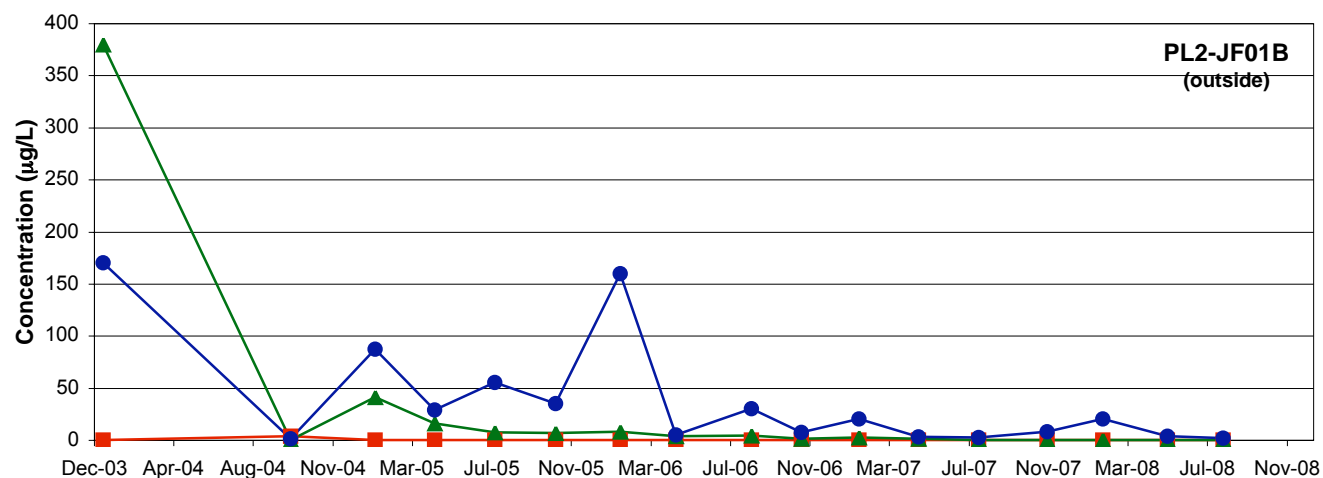
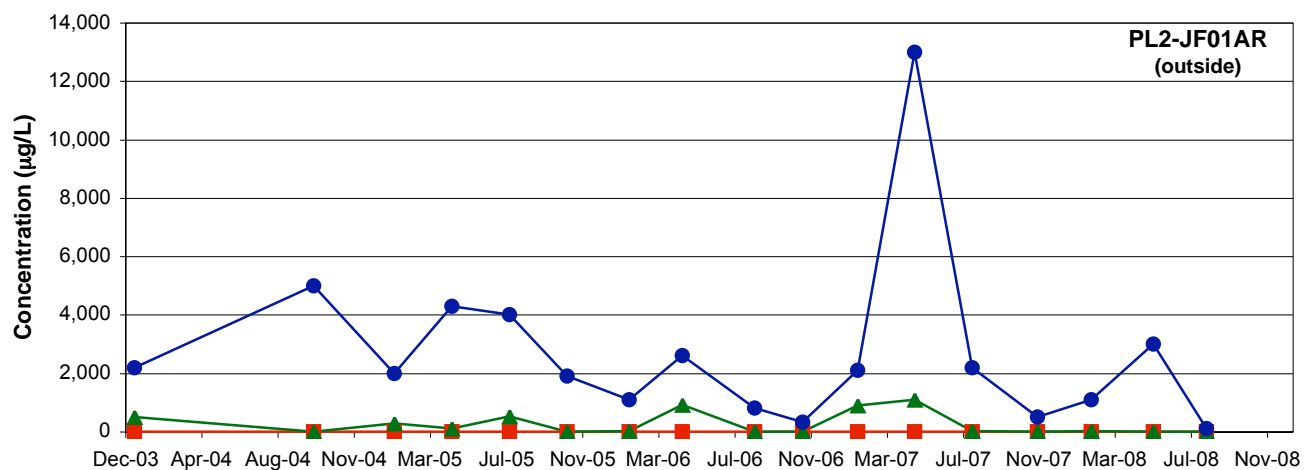
Legend

- Trichloroethene (µg/L)
- ▲— cis-1,2-Dichloroethene (µg/L)
- Vinyl Chloride (µg/L)



FIGURE 4f  
CHLORINATED VOC TRENDS AT  
PL2-043B AND PL2-044B  
(see Table 4 for aggregate results)

Project	Boeing Plant 2		
Prepared For	The Boeing Company		
Location	7725 East Marginal Way Seattle/Tukwila, Washington		
	Drawn By JEB	Reviewed By JLD	Date 12/30/08



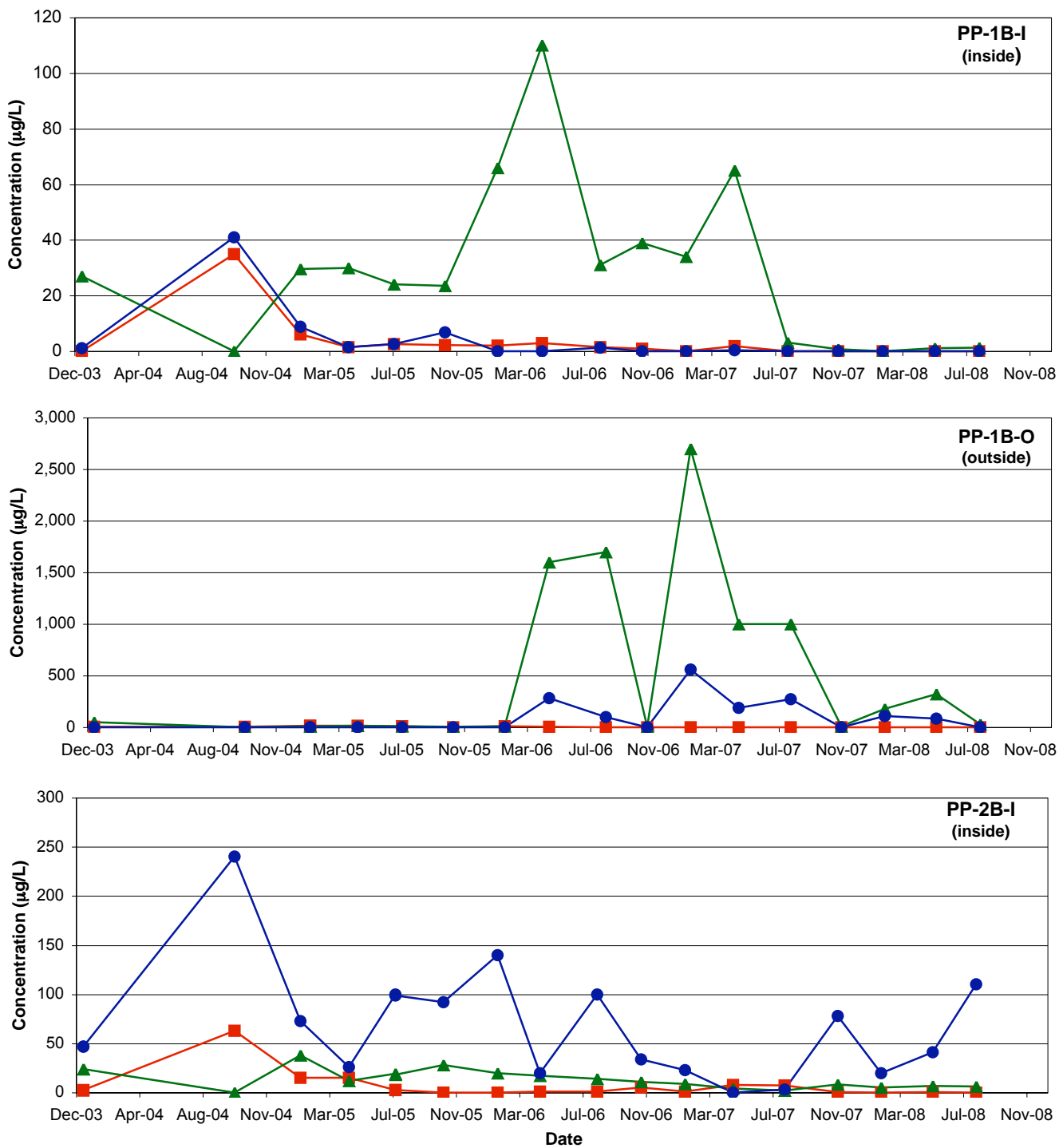
Legend

- Trichloroethene (µg/L)
- cis-1,2-Dichloroethene (µg/L)
- Vinyl Chloride (µg/L)



FIGURE 4g  
CHLORINATED VOC TRENDS AT  
PL2-JF01AR, PL2-JF01B, and PL2-JF01C  
(see table 4 for aggregate results)

Project	Boeing Plant 2		
Prepared For	The Boeing Company		
Location	7725 East Marginal Way Seattle/Tukwila, Washington		
	Drawn By JEB	Reviewed By JLD	Date 12/30/08



Legend

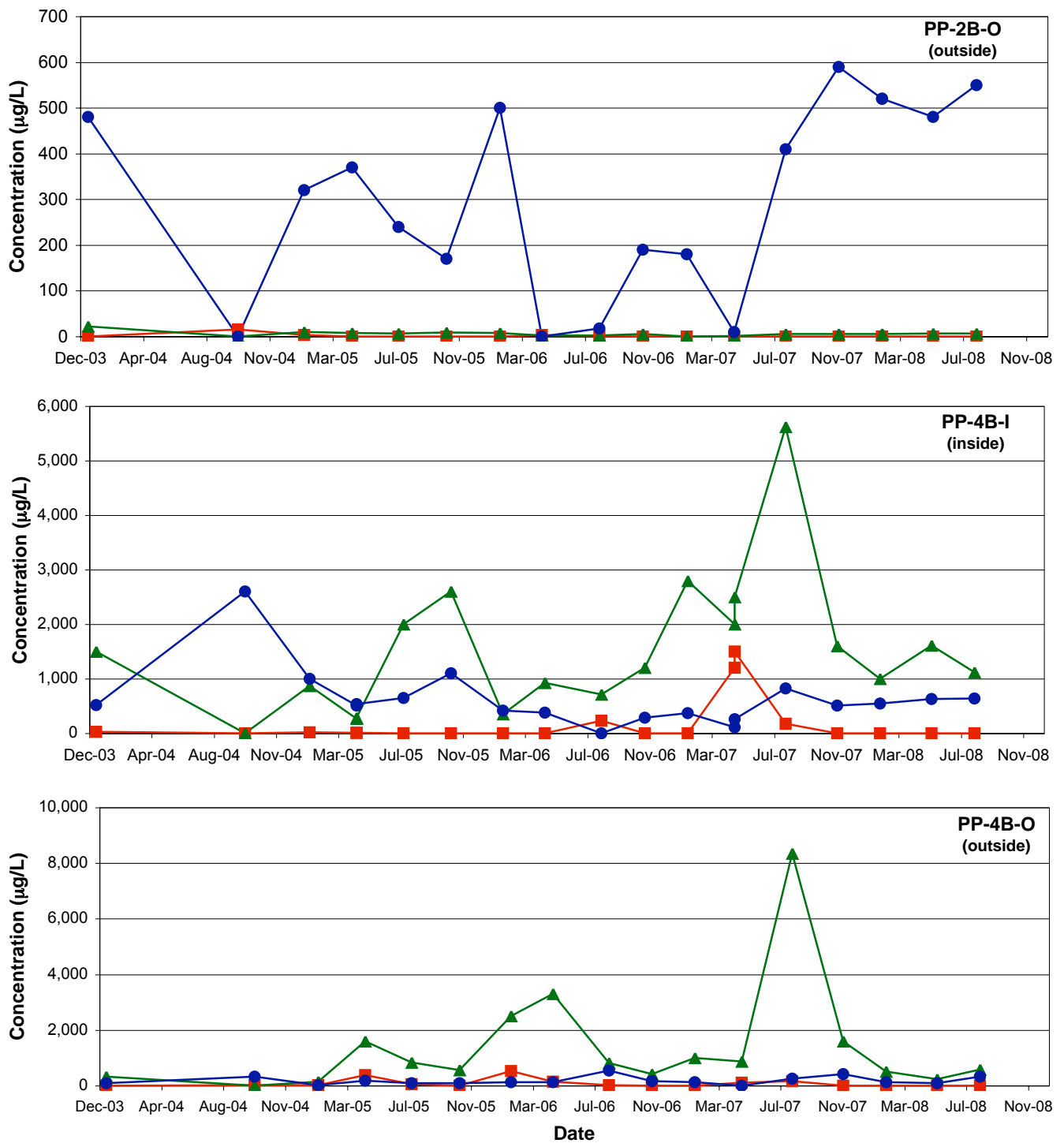
- Trichloroethene (µg/L)
- cis-1,2-Dichloroethene (µg/L)
- Vinyl Chloride (µg/L)



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FIGURE 4h  
CHLORINATED VOC TRENDS AT  
PP-1B-I, PP-1B-O, AND PP-2B-I  
(see Table 4 for aggregate results)

Project	Boeing Plant 2		
Prepared For	The Boeing Company		
Location	7725 East Marginal Way Seattle/Tukwila, Washington		
Drawn By	Reviewed By	Date	
JEB	JLD	12/30/08	



Legend

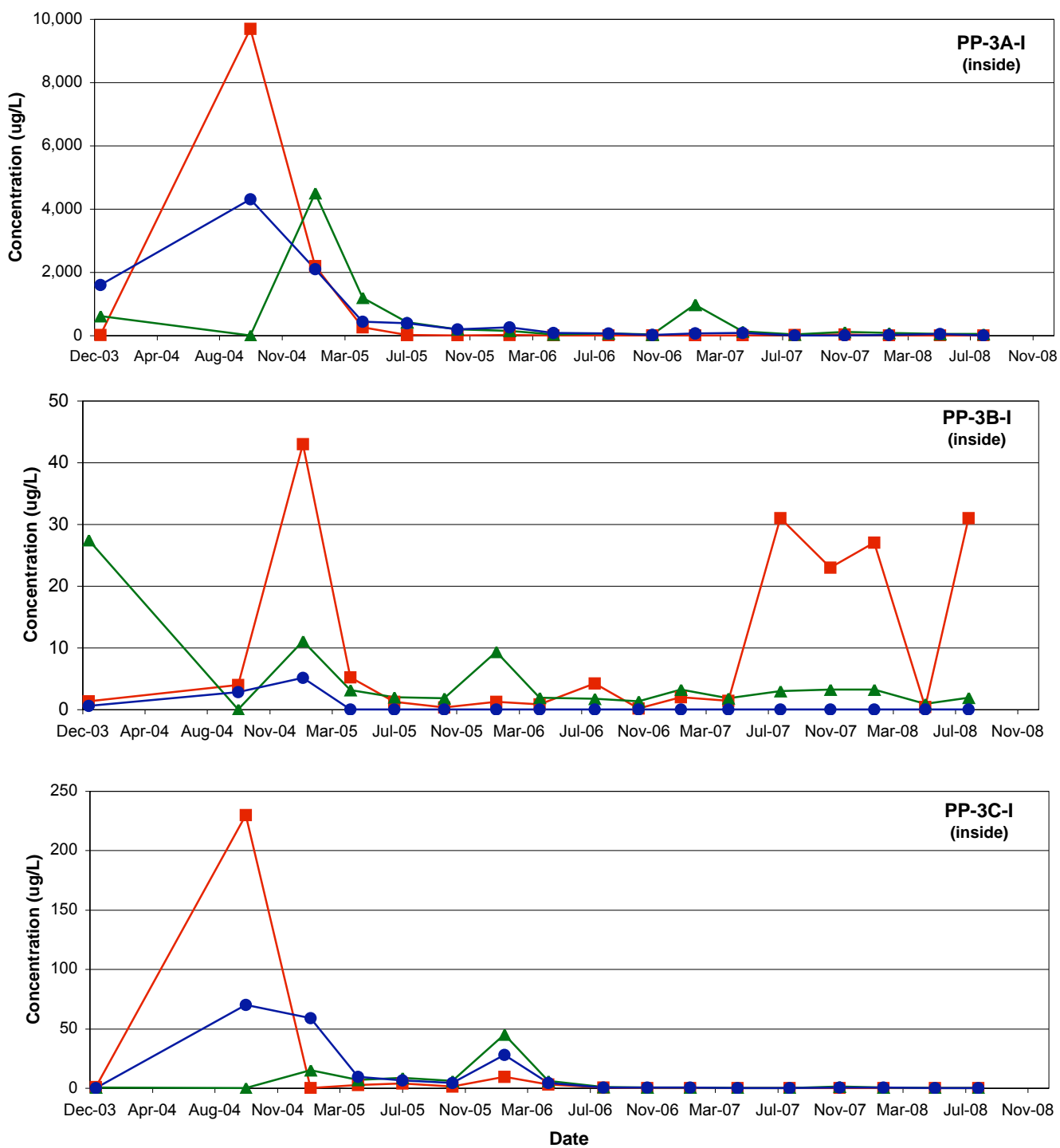
- Trichloroethene (µg/L)
- ▲— cis-1,2-Dichloroethene (µg/L)
- Vinyl Chloride (µg/L)



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FIGURE 4i  
CHLORINATED VOC TRENDS AT  
PP-2B-O, PP-4B-I, AND PP-4B-O  
(see Table 4 for aggregate results)

Project	Boeing Plant 2		
Prepared For	The Boeing Company		
Location	7725 East Marginal Way Seattle/Tukwila, Washington		
Drawn By	JEB	Reviewed By	JLD
Date	12/30/08		



Legend

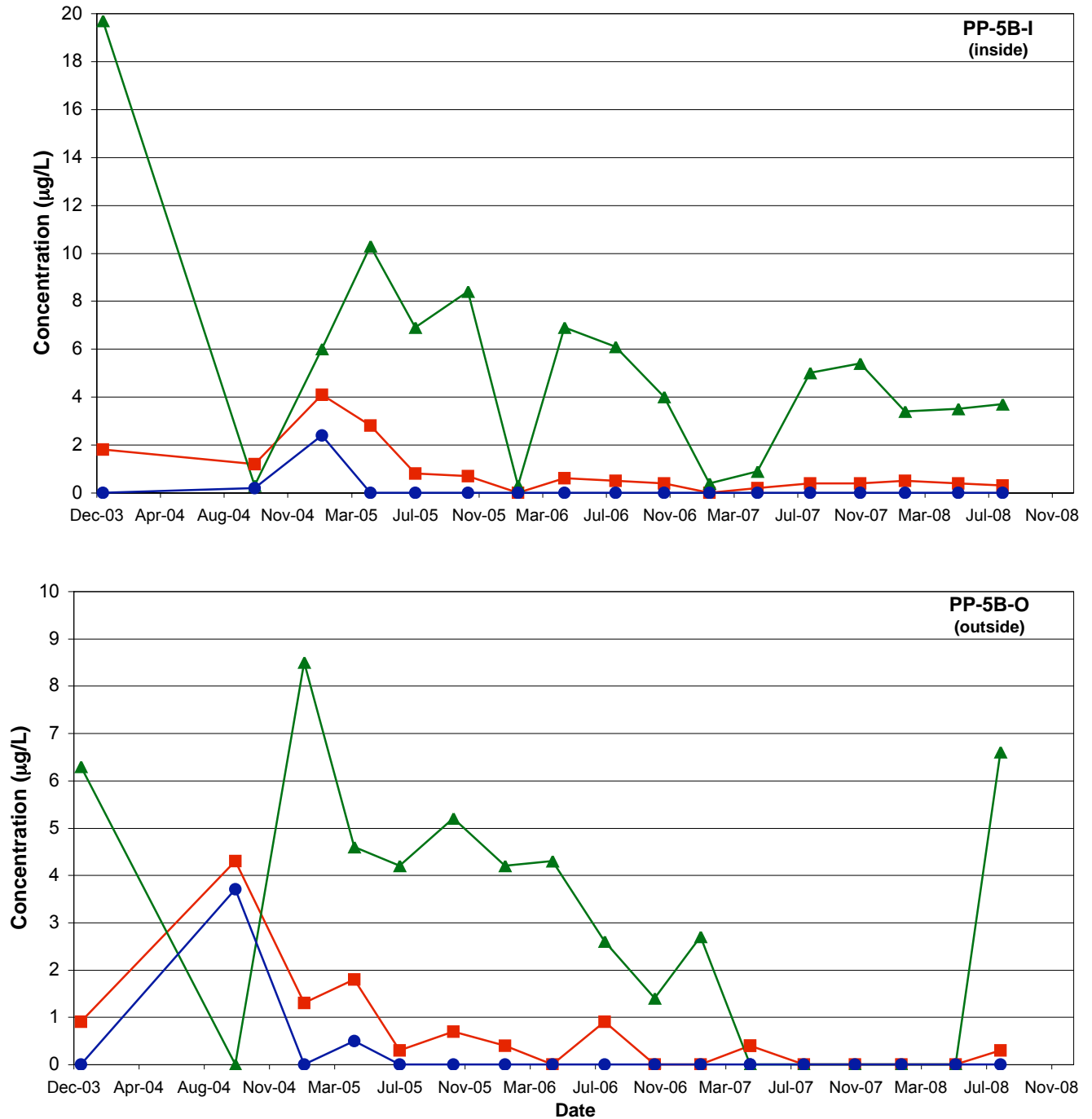
- Trichloroethene (ug/L)
- cis-1,2-Dichloroethene (ug/L)
- Vinyl Chloride (ug/L)



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FIGURE 4j  
CHLORINATED VOC TRENDS AT  
PP-3A-I, PP-3B-I, AND PP-3C-I  
(see Table 4 for aggregate results)

Project	Boeing Plant 2		
Prepared For	The Boeing Company		
Location	7725 East Marginal Way Seattle/Tukwila, Washington		
	Drawn By JEB	Reviewed By JLD	Date 12/30/08



Legend

- Trichloroethene (µg/L)
- ▲— cis-1,2-Dichloroethene (µg/L)
- Vinyl Chloride (µg/L)



**ENVIRONMENTAL  
PARTNERS INC**

FIGURE 4k  
CHLORINATED VOC TRENDS AT  
PP-5B-I AND PP-5B-O  
(see Table 4 for aggregate results)

Project	Boeing Plant 2		
Prepared For	The Boeing Company		
Location	7725 East Marginal Way Seattle/Tukwila, Washington		
Drawn By	Reviewed By	Date	
JEB	JLD	12/30/08	

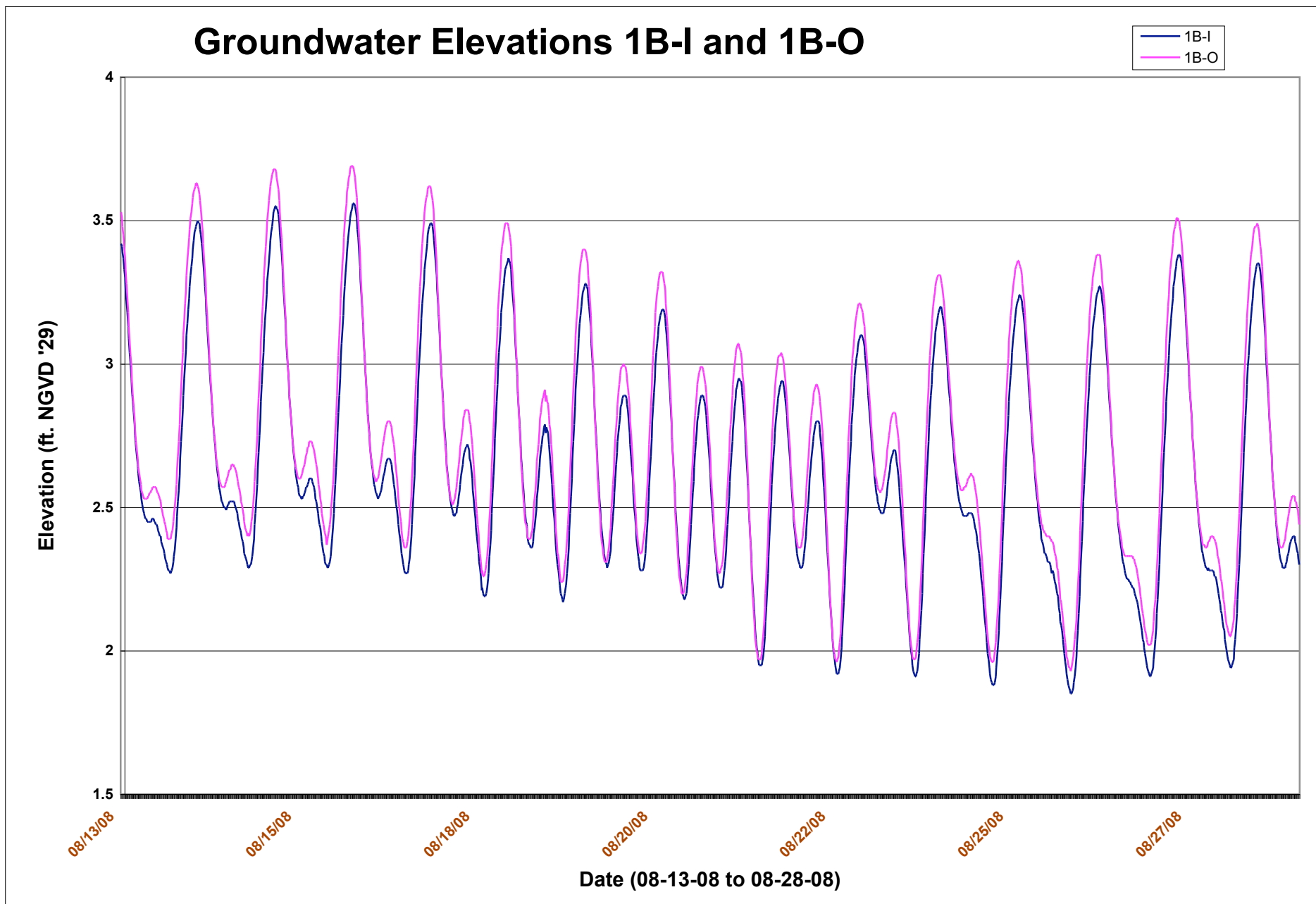


Figure 5a. Groundwater Elevations at Wells PP-1B-I and PP-1B-O (16th Quarter)

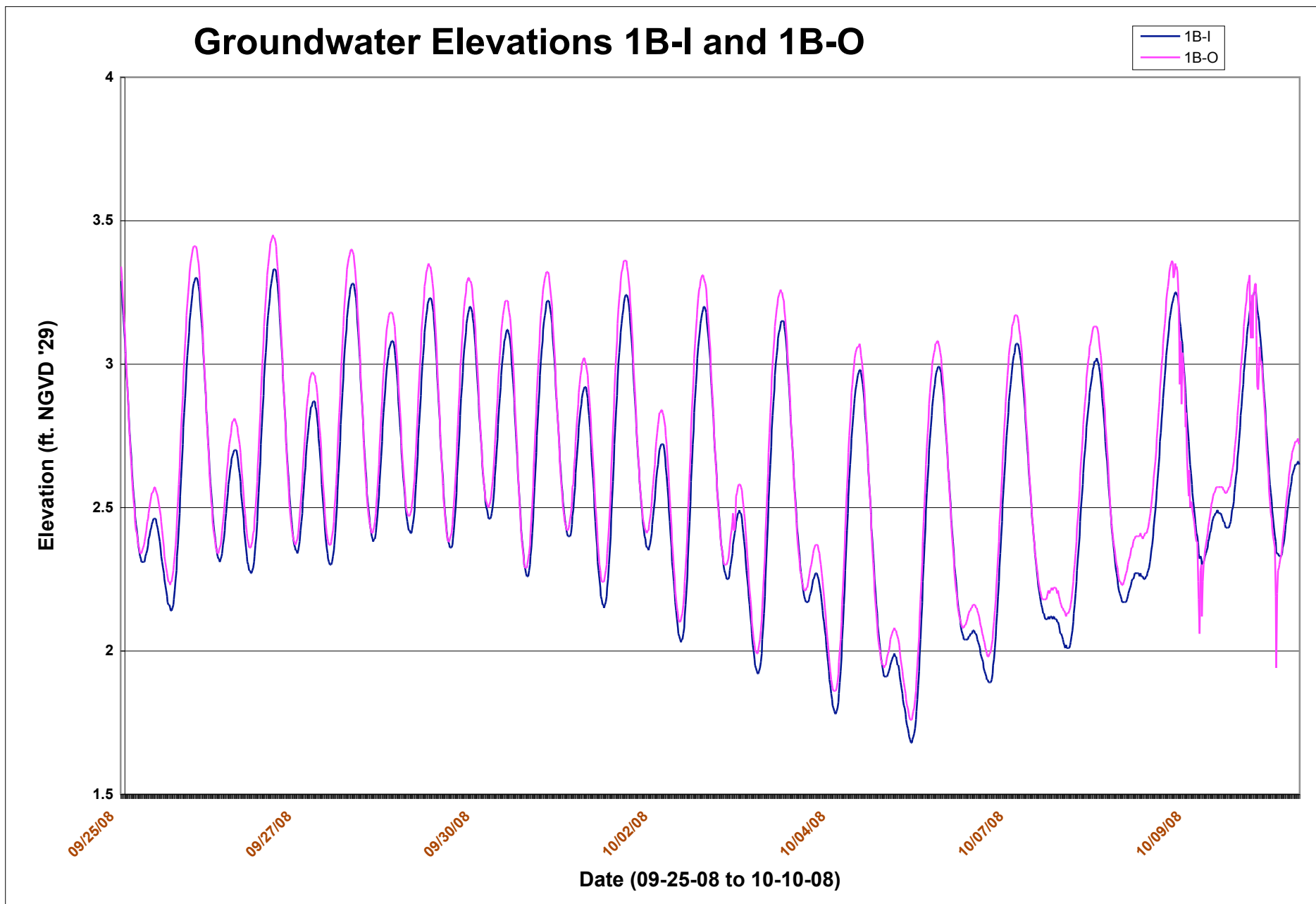


Figure 5b. Groundwater Elevations at Wells PP-1B-I and PP-1B-O (17th Quarter)

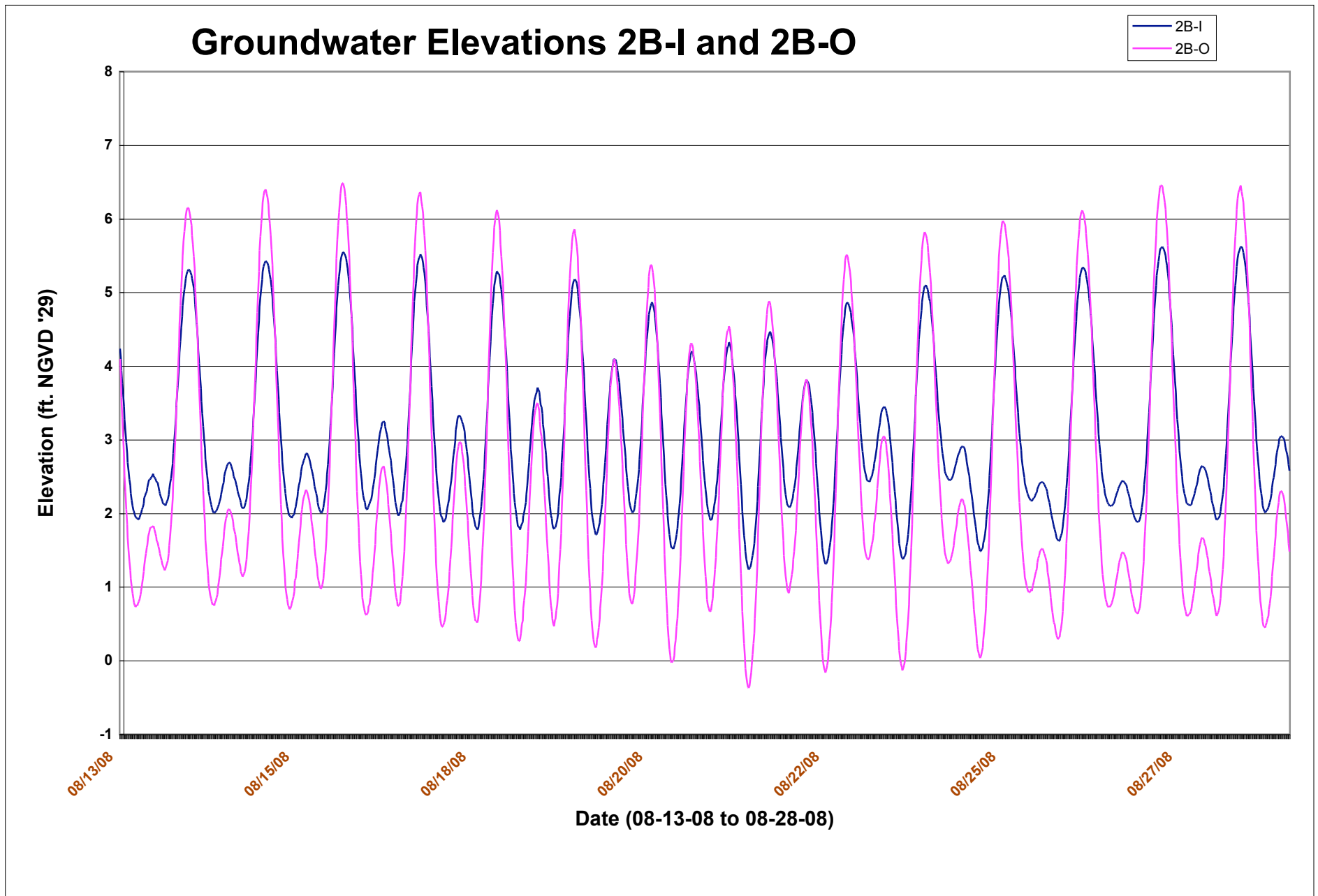


Figure 6a. Groundwater Elevations at Wells PP-2B-I and PP-2B-O (16th Quarter)

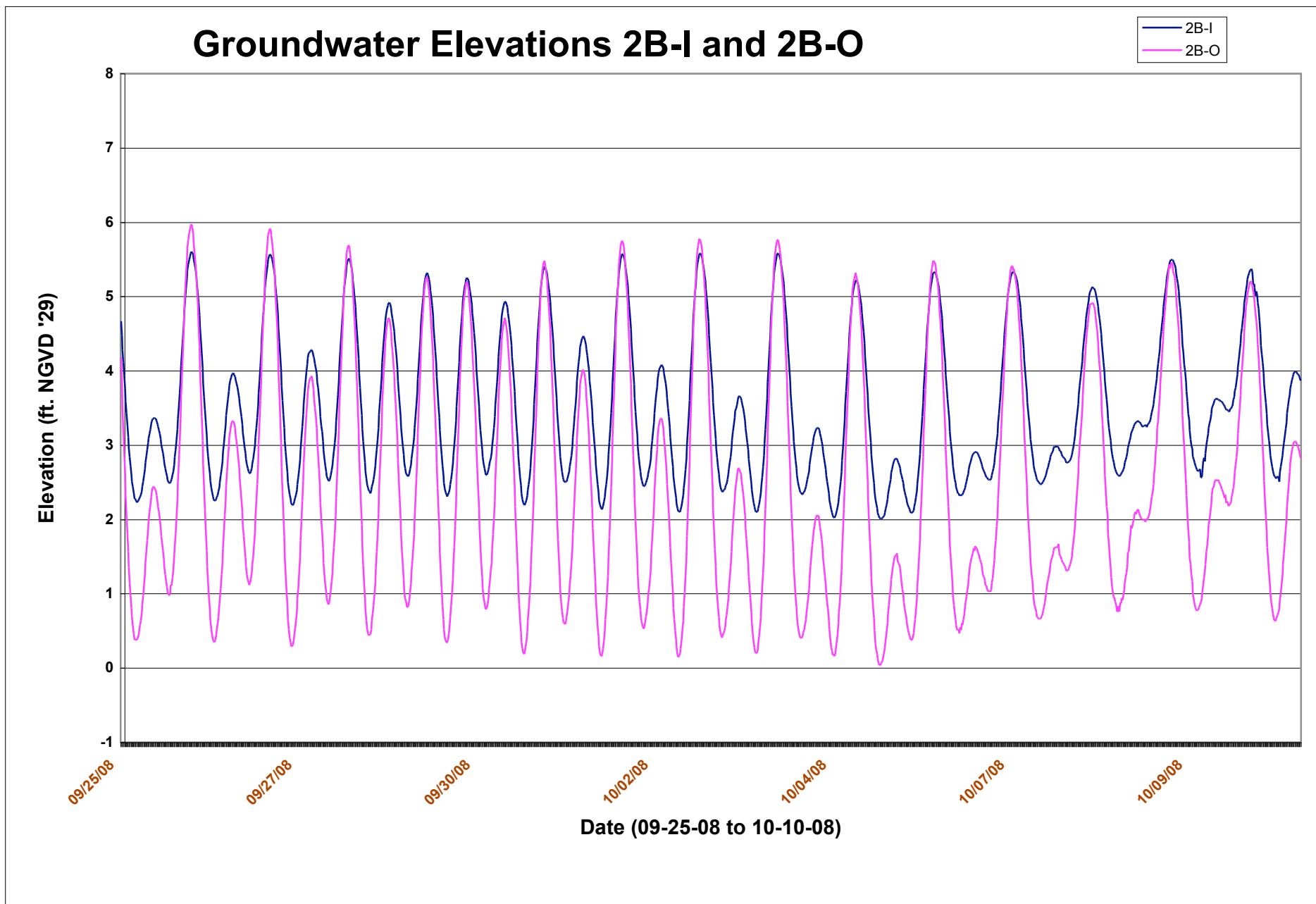


Figure 6b. Groundwater Elevations at Wells PP-2B-I and PP-2B-O (17th Quarter)

## **Attachment A**

### **PERFORMANCE MONITORING – FIELD PARAMETER MEASUREMENTS**

Performance Monitoring - 16th Quarter Field Parameter Measurements (8/2008)							
2-66 IM DDC System							
Well ID	pH	Dissolved Oxygen (mg/L)	ORP (mV)	Temp (°C)	Turbidity (NTU)	Specific Conductance (mS/cm)	Depth to Water (ft)
DDC2-66-1D	6.10	0.0	-12	17.7	ND	3.30	10.65
DDC2-66-1S	ND	ND	ND	ND	ND	ND	ND
DDC2-66-2D	5.35	0.0	31	15.6	ND	3.01	9.66
DDC2-66-2S	ND	ND	ND	ND	ND	ND	ND
PL2-007AR	6.09	0.0	127	15.5	ND	1.35	11.07
PL2-041AA (008A)	7.27	0.0	-72	15.9	ND	1.07	10.40
PL2-008B	6.74	0.0	-76	15.5	ND	3.46	10.89
PL2-008C	7.70	0.0	-65	15.3	ND	5.42	10.76
PL2-010A	3.89	0.0	59	15.6	ND	3.75	10.18
PL2-017A	6.04	0.0	30	16.0	ND	9.52	10.32
PL2-021A	4.49	0.0	59	15.7	ND	3.74	10.71
PL2-021B	7.19	0.0	-87	15.2	ND	4.93	10.69
PL2-021C	7.87	0.0	-193	15.3	ND	22.26	10.88
PL2-030A*	7.07	6.5	-405	13.5	ND	1.36	11.10
PL2-030C*	8.02	27.7	-301	14.7	ND	4.39	10.30
PL2-031A	6.95	0.0	-35	15.5	ND	1.87	10.44
PL2-032A	6.69	0.0	-72	15.3	ND	2.48	10.48
PL2-034A	6.77	0.0	-12	16.9	ND	1.82	12.28
PL2-035A	6.50	0.0	-26	16.5	ND	2.85	10.44
PL2-043B*	7.36	4.9	-317	14.1	ND	17.97	8.80
PL2-044B*	7.60	9.2	-492	14.3	ND	12.46	9.10
PL2-JF01AR*	6.71	10.4	-242	14.5	ND	0.94	9.80
PL2-JF01B*	6.76	18.5	-242	15.5	ND	7.32	10.10
PL2-JF01C*	6.84	9.2	-207	14.9	ND	20.22	11.03
PP-1B-I	7.47	0.0	-125	15.8	ND	9.03	11.77
PP-1B-O	7.46	0.0	-69	15.9	ND	7.45	11.78
PP-2B-I	6.98	0.0	-111	17.8	ND	5.05	11.67
PP-2B-O	6.84	0.0	-64	17.6	ND	4.69	12.47
PP-3A-I	6.60	0.0	7	13.7	ND	2.42	10.31
PP-3B-I	6.82	0.0	47	13.7	ND	9.84	10.22
PP-3C-I	7.47	0.0	-121	14.3	ND	7.08	9.92
PP-4B-I	6.64	0.0	-31	16.6	ND	3.85	10.72
PP-4B-O	6.90	0.0	7	16.0	ND	4.46	10.63
PP-5B-I	7.06	0.0	-48	15.2	ND	15.88	10.44
PP-5B-O	6.55	0.0	-7	15.6	ND	14.44	10.38

Notes:

ORP = oxidation-reduction potential, mv = millivolts

NTU = nephelometric turbidity units

mS/cm - milliSiemens per centimeter

ND = no data

\* = field data and sample collected by Boeing

**Attachment B**

**ANALYTICAL DATA VALIDATION REPORT**

**BOEING PLANT 2 – 2-66 SHEETPILE STRUCTURE  
THIRD QUARTER 2008 GROUNDWATER PERFORMANCE MONITORING  
DATA VALIDATION QA/QC REVIEW**

A total of twenty-nine groundwater samples (including duplicates) and three trip blank samples were collected August 4-6 of 2008 as part of the Boeing Plant 2 Groundwater Interim Measures Work Plan for the Sheetpile Structure at Building 2-66 Project (October, 2003). Samples were analyzed by Analytical Resources Incorporated (ARI) of Tukwila, Washington for the following parameters:

- Volatile organic compounds (VOCs) by EPA Method 8260B
- Metals - Silver, Arsenic, Beryllium, Cadmium, Calcium, Chromium, Copper, Mercury, Nickel, Lead, Antimony, Selenium, Thallium, Zinc, Iron, Magnesium, Manganese, and Vanadium (Total) by EPA Methods 200.8, 6010B, and 7470A
- Geochemistry Parameters - Calcium, Manganese, and Iron (Total and Dissolved) by EPA Method 6010B and Alkalinity by SM 2320

Samples were analyzed in accordance with procedures described in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (USEPA SW-846, 3rd edition) 8260B, 6010B, 7470A metals, EPA Method 200.8, Revision 5.5; Determination of Trace Elements in Water and Wastes by Inductively Coupled Plasma-Mass Spectrometry, and Standard Methods for the Examination of Water and Wastewater (21<sup>st</sup> Edition)*.

Samples were analyzed and results reported by the laboratory in batch numbers as summarized below:

**NJ00/NJ01 (VOCs, Total Metals, Low Level Mercury, and Geochemistry Parameters):**

GW-080804-PL2-032A-0	GW-080804-PL2-021C-0	GW-080804-DDC2-66-20-0
GW-080804-PL2-021A-0	GW-080804-PP-1B-I-0	GW-080804-PL2-001-2 (Trip Blank)
GW-080804-PL2-021A-1	GW-080804-PP-1B-O-0	
GW-080804-PL2-021B-0	GW-080804-DDC2-66-10-0	

**NJ15/NJ16 (VOCs, Total Metals, Low Level Mercury, and Geochemistry Parameters):**

GW-080805-PP-3A-I-0	GW-080805-PL2-035A-0	GW-080805-PP-2B-I-0
GW-080805-PP-3B-I-0	GW-080805-PL2-035A-1	GW-080805-PL2-031A-0
GW-080805-PP-3C-I-0	GW-080805-PP-2B-O-0	GW-080805-PL2-001-2 (Trip Blank)
GW-080805-PL2-010A-0	GW-080805-PL2-034A-0	

**NJ46/NJ47 (VOCs, Total Metals, and Low Level Mercury):**

GW-080806-PL2-007AR-0	GW-080806-PP-5B-I-0	GW-080806-PL2-008C-0
GW-080806-PP-4B-O-0	GW-080806-PP-5B-O-0	GW-080806-PL2-041AA-0
GW-080806-PP-4B-I-0	GW-080806-PL2-017A-0	GW-080806-PL2-001-2 (Trip Blank)
GW-080806-PP-4B-I-1	GW-080806-PL2-008B-0	

Quality assurance/quality control (QA/QC) reviews of laboratory data were performed in the laboratory in accordance with the laboratory quality assurance program plan. The data validation QA/QC review focused primarily on laboratory result summary sheets and quality control summary sheets to ensure that work plan data quality objectives were met for the project. Data validation was conducted in accordance with the criteria outlined in the National Functional Guidelines for Organic Data Review (EPA 1999) and the National Functional Guidelines for Inorganic Data Review (EPA 2004), modified to include method specific requirements of the laboratory analytical methods. Raw data sheets were reviewed as necessary to confirm conditions reported and to support application of qualifiers to analytical results.

The validation level for the data is Level 2, as described in the workplan (EPI, 2003). The following is a summary of quality control elements associated with each analytical fraction and the status of that element as a result of the data validation process.

### **SAMPLING, DOCUMENTATION AND REPORTING**

It was noted during review of the EPI workplan against the laboratory reporting limits for metals that the units in the workplan are indicated in mg/L whereas the correct units should be µg/L, which is what is being reported by the laboratory. Samples submitted for alkalinity analysis were analyzed by SM2320 instead of EPA 310.0 method as stipulated in the EPI workplan. No action was taken as methods are generally comparable.

The EPI QAPP stipulates that low level mercury is to be performed by Brooks Rand LLC, in Seattle, WA. Low level mercury analysis was to be performed by EPA Method 1631E. In late 2005 ARI satisfactorily adapted and tested a low level mercury method, EPA Method 7470A. Since May of 2006 ARI has been performing low level mercury analysis for this project.

- SDGs NJ01, NJ16, and NJ47: Refer to these SDGs for low level mercury results.
- SDGs NJ00/NJ01 and NJ15/NJ16: Several samples were received insufficiently or unpreserved for metals analysis. The laboratory preserved the samples upon receipt, prior to analysis. EPI was made aware that selected samples needed additional preservation upon laboratory receipt of the samples and EPI, for future sampling efforts, will take action to identify various conditions that may be causing this. Potentially impacted sample results were also compared with historical data (monitoring wells - PL2-021C, PL2-021B, PP-3C-I, and PL2-010A). Third quarter metal results generally appear to be consistent with historical data. No further action was taken.
- SDG NJ15/NJ16: Cooler receipt form indicates that the cooler was received at 15.2 °C and 5.6 °C though laboratory notes appear to indicate that insufficient ice was used. Given that the samples were collected and delivered on the same day samples would not have had time to cool sufficiently.
- SDG NJ46/NJ47: Case narrative identification for Sample GW-0806-PP-5B-O-0 was corrected by the data validator to read GW-080806-PP-5B-O-0.
- Results for volatile organic compound 1, 1, 2-trichloro-1, 2, 2-trifluoroethane are reported in a truncated format (1, 1, 2-trichloro-1, 2, 2-trifluoroe) due to ARI report format. No action was taken.

## VOLATILE ORGANIC COMPOUNDS

Full data packages were provided for the VOC analysis. The items reviewed during validation are summarized below.

### Analytical Methods – *acceptable*

Samples for VOC analysis were analyzed by gas chromatography/mass spectrometry (GC/MS) using EPA SW846 Method 8260B.

### Sample Holding Times and Preservation

All samples were prepared and analyzed within 14 days of sample collection (preserved water samples) or within 7 days of sample collection (unpreserved water samples).

### Laboratory Reporting Limits – *acceptable*

The laboratory achieved the reporting limits (RLs) required by the approved quality assurance project plan (EPI, 2003) with the following exceptions:

- Quality assurance project plan (QAPP) reporting limits were not met for eight compounds. A review of current ARI detection limits shows that both method and reporting limits were recently updated. Compounds that do not meet QAPP stipulated reporting levels (RLs) are identified in the following table:

Compound	QAPP Table C-1B RLs (µg/L)	Lab Reported RLs (µg/L)
Bromomethane	0.2	0.5
Methylene Chloride	0.3	0.5
Acetone	1.0	3.0
2-Butanone	1.0	2.5
Vinyl Acetate	0.2	1.0
2-Chloroethylvinylether	0.5	1.0
4-Methyl-2-Pentanone	1.0	2.5
2-Hexanone	1.0	2.5

A total of forty-one compounds are listed on Table C-1B of the QAPP. Thirty-nine compounds were analyzed for but no action was necessary as Table C-1B lists 1, 2-Dichloroethene (Total) and Xylene (Total) which can be acquired from the compound list.

The reporting limits were not met in cases in which the samples were analyzed at dilutions due to high concentrations of target compounds.

### Instrument Calibration and Tuning

A review of the instrument tuning and calibration was performed. All of the calibration criteria for the target analytes, as listed in the EPI Workplan, were met with the following exceptions:

Sample	Compound	Qualification	Reason
NJ00	2-Butanone	UR/J	ICAL RRF <0.05

Sample	Compound	Qualification	Reason
GW-080804-PL2-032A-0 GW-080804-PL2-021A-0 GW-080804-PL2-021A-0 DIL GW-080804-PL2-021A-1 GW-080804-PL2-021A-1 DIL GW-080804-PP-IB-O-0 REANALYSIS	2-Chloroethylvinylether (2CEVE)		
NJ00 GW-080804-PL2-032A-0 GW-080804-PL2-021A-0 GW-080804-PL2-021A-0 DIL GW-080804-PL2-021A-1 GW-080804-PL2-021A-1 DIL GW-080804-PP-IB-O-0 REANALYSIS	Ethylbenzene m, p – xylene	UJ/J	ICAL R <sup>2</sup> <0.995
NJ00 GW-080804-PL2-021B-0 GW-080804-PL2-021C-0 GW-080804-PP-IB-I-0 GW-080804-PP-IB-O-0	Carbon Disulfide	UJ/J	CCAL % D >25%
NJ15 GW-080805-PP-3A-I-0 GW-080805-PL2-010A-0 GW-080805-PL2-035A-0 GW-080805-PL2-035A-1 GW-080805-PP-2B-O-0 GW-080805-PL2-034A-0	2-Butanone 2CEVE	UR/J	ICAL RRF <0.05
NJ15 GW-080805-PP-3A-I-0 GW-080805-PL2-010A-0 GW-080805-PL2-035A-0 GW-080805-PL2-035A-1 GW-080805-PP-2B-O-0 GW-080805-PL2-034A-0	Ethylbenzene m, p – xylene	UJ/J	ICAL R <sup>2</sup> <0.995
NJ46 GW-080806-PL2-007AR-0 REANALYSIS GW-080806-PP-4B-O-0 REANALYSIS GW-080806-PP-4B-I-0 REANALYSIS GW-080806-PP-4B-I-I REANALYSIS GW-080806-PL2-008B-0 GW-080806-PL2-041AA-0	2-Butanone 2CEVE	UR/J	ICAL RRF <0.05
NJ46 GW-080806-PL2-007AR-0 REANALYSIS GW-080806-PP-4B-O-0 REANALYSIS GW-080806-PP-4B-I-0 REANALYSIS GW-080806-PP-4B-I-I REANALYSIS GW-080806-PL2-008B-0 GW-080806-PL2-041AA-0	Ethylbenzene m, p – xylene	UJ/J	ICAL R <sup>2</sup> <0.995

### **Blank Contamination**

The method, calibration, and trip blanks were free of target compounds with the following exceptions:

- SDG NJ00: Methylene chloride was detected in the method blank. The methylene chloride detection in the associated Trip Blank (Sample GW-080804-PL2-001-2) falls below the established action level criteria and is thus qualified as not detected (U).
- SDGs NJ15 and NJ46: Low levels of acetone and/or methylene chloride were detected in associated method blanks but no action was necessary as these compounds were not detected in associated samples.

### **Surrogate Recovery – *acceptable***

All surrogate recoveries were within control limits.

### **Matrix Spike Compound Recovery**

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) analysis was performed on two samples. In cases where MS/MSD data are not available refer to LCS/LCSD and field duplicate data for precision and accuracy information. All MS/MSD recoveries and relative percent differences (RPDs) were acceptable with the following exceptions:

- SDG NJ15: MS/MSD analysis was performed as requested on sample GW-080805-PL2-010A-0. Percent recoveries for spike compound 2-chloroethylvinylether (2CEVE) were reported as “NA”. Compound 2CEVE for parent sample GW-080514-PP-3C-I-0 was already qualified as rejected (UR) due to poor initial calibration results.
- SDG NJ46: MS/MSD analysis was performed as requested on sample GW-080806-PP-5B-O-0. Percent recoveries for spike compound 2-chloroethylvinylether (2CEVE) were reported as “NA”. Compound 2CEVE for parent sample GW-080806-PP-5B-O-0 was qualified as rejected (UR) due to poor MS/MSD results.

### **Laboratory Control Sample Recovery – *acceptable***

Laboratory control samples (LCS) were evaluated using control limits 70 to 130 percent. In several cases LCS or LCSD compounds were slightly outside the criteria but are considered acceptable based on updated ARI control limits and other QC criteria associated with the data.

### **Internal Standard**

The internal standard criteria were met.

### **Field Duplicate Sample Analysis – *acceptable***

Field duplicate sample was collected and analyzed as follows:

<b>Laboratory SDG</b>	<b>Sample</b>	<b>Field Duplicate Sample</b>
NJ00/NJ01	GW-080804-PL2-021A-0	GW-080804-PL2-021A-1

Laboratory SDG	Sample	Field Duplicate Sample
NJ15/NJ16	GW-080805-PL2-035A-0	GW-080805-PL2-035A-1
NJ46/NJ47	GW-080806-PP-4B-I-0	GW-080806-PP-4B-I-0

Field duplicate analysis criteria were met.

## INORGANICS

The laboratory provided a full data package for the inorganic analysis; the items reviewed during validation are summarized below.

### Analytical Methods – *acceptable*

Samples for total metals analysis were prepared using EPA Methods 3010A or 200.8, acid digestion. Metals analysis was completed by EPA Methods 6010B and 200.8. Samples for trace mercury analysis were prepared and analyzed by cold vapor atomic absorption spectrometry (CVAA) using ARI's Draft SOPs #533S and #539S (method is based on EPA Method 7470A).

### Sample Holding Times – *acceptable*

All samples were prepared and analyzed within the recommended holding period from the date of collection; 180 days for metals and 28 days for mercury. All holding time criteria were met.

### Laboratory Reporting Limits

The laboratory achieved the reporting limits (RLs) required by the approved quality assurance project plan (EPI, 2003) with the following discussions and exceptions:

- The reporting limits were not met in cases in which the samples were analyzed at dilutions due to high concentrations of target compounds or interferences. No action was taken.
- Early 2007, due to ongoing zinc contamination within ARI's metals laboratory, zinc reporting level for EPA Method 6010B was revised from 6 µg/L to 10 µg/L. The revised reporting limit for zinc is higher than the QAPP Table C-1B criteria of 6 µg/L. No action was taken.
- Calcium, manganese, magnesium, and iron reporting limits are not listed in the QAPP. No action was taken.
- SDGs NJ00 and NJ15: In several cases dissolved metal results (calcium, manganese, and iron) were greater in the dissolved fraction than the respective total fraction. No action was taken.
- The QAPP stipulates that low level mercury is to be performed by Brooks Rand LLC, in Seattle, WA. Low level mercury analysis was to be performed by EPA Method 1631E. In late 2005 ARI satisfactorily adapted and tested a low level mercury method, EPA Method 7470A. Since May of 2006 ARI has been performing low level mercury analysis for this project.

### **Initial and Continuing Calibration Verification - *acceptable***

All initial (ICV) and continuing calibration verification (CCV) sample analysis results for total and dissolved metals analyses were within 10% (20% for mercury) of the initial calibration with one exception:

- SDG NJ15: Copper CCV (CCV3 and CCV4 on August 18, 2008) percent recoveries were elevated however no action was taken on this basis since copper was detected above the reporting limit in August 18, 2008 continuing calibration blanks (CCB3, CCB4, and CCB5). Copper detections falling under the action level in associated samples were qualified as not detected (U). Refer to the next section for further details.

### **Blank Contamination**

The method blank and continuing calibration blanks were free of target compounds with the following exceptions:

Samples	Analyte	Qualification
NJ00 GW-080804-PL2-021C-0 GW-080804-PP-IB-O-0	Copper (in continuing calibration blank)	U
NJ15 GW-080805-PP-3A-I-0 GW-080805-PP-3C-I-0 GW-080805-PL2-035A-0 GW-080805-PL2-035A-1 GW-080805-PP-2B-O-0 GW-080805-PL2-034A-0 GW-080805-PP-2B-I-0 GW-080805-PL2-031A-0	Copper (in continuing calibration blank)	U

### **Laboratory Control Sample Recovery – *acceptable***

LCS (blank spike) samples were performed with each analytical batch. All LCS recoveries and relative percent differences (RPDs) were acceptable and within the QC limits of 80 to 120 percent.

### **Matrix Spike Analysis**

Matrix Spike (MS) analysis was performed on selected samples in analytical batches. All MS recoveries were acceptable with the following discussion:

- SDGs NJ00, NJ15, and NJ46: MS percent recoveries for certain metals (e.g. iron and calcium) were qualified 'H' by ARI to indicate that these metal concentrations in the spiked samples were greater than 4X the spike amount. No action was taken.

### **Duplicate Analysis - *acceptable***

Laboratory duplicate analysis was performed on selected samples in analytical batches. Duplicate analysis criteria were met.

### **Interference Check Sample Analysis - *acceptable***

All interference check sample analysis results for total metals were within 20% of the true value and analyzed at the appropriate frequencies.

### **Linear Range Check Standard - *acceptable***

The linear range check standard analyzed for ICP analyses was within  $\pm 10\%$ .

### **Internal Standard Analysis - *acceptable***

Internal standard results were monitored for ICP-MS analysis. All internal standard recoveries were within 60 to 120 percent of the standard.

### **ICP Serial Dilution Analysis - *acceptable***

All serial dilution results were less than 10% difference between the initial and final results and less than 50 times the sample MDL.

### **Field Duplicate Sample Analysis**

Field duplicate samples were collected and analyzed as follows:

<b>Laboratory SDG</b>	<b>Sample</b>	<b>Field Duplicate Sample</b>
NJ00/NJ01	GW-080804-PL2-021A-0	GW-080804-PL2-021A-1
NJ15/NJ16	GW-080805-PL2-035A-0	GW-080805-PL2-035A-1
NJ46/NJ47	GW-080806-PP-4B-I-0	GW-080806-PP-4B-I-0

Work plan goals for precision were met for total metals and Geochemistry total and dissolved metals.

## **GENERAL CHEMISTRY**

The laboratory provided a full data package for the inorganic analysis; the items reviewed during validation are summarized below.

### **Analytical Methods and Reporting – *acceptable***

Samples submitted for alkalinity analysis were analyzed by SM2320 instead of EPA 310.0 method as stipulated in the EPI workplan. No action was taken as methods are generally comparable.

Review of the alkalinity bench sheets indicates that a number of samples had a pH of less than 4.5, a titration endpoint for the method. The alkalinity test was terminated after the initial pH (of less than 4.5) was determined for the following samples from SDG NJ00 (GW-080804-PL2-021A-0 and GW-080804-PL2-021A-1), and SDG NJ15 (GW-080805-PL2-010A-0).

### **Sample Holding Times – *acceptable***

All samples were prepared and analyzed within the recommended holding period from the date of collection of 14 days from collection to analysis.

### **Laboratory Reporting Limits – *acceptable***

The laboratory achieved the reporting limits (RLs) required by the approved quality assurance project plan (EPI, 2003).

### **Initial and Continuing Calibration Verification - *acceptable***

All initial and continuing calibration verification sample analysis results were within 10% of the initial calibration

### **Blank Contamination – *acceptable***

The initial calibration blanks were free of target compounds.

### **Standard Reference Material – *acceptable***

A standard reference material (SRM) sample was analyzed per analytical batch. All SRM recoveries were acceptable.

### **Duplicate Analysis- *acceptable***

Duplicate analysis was analyzed per analytical batch. All RPD criteria were met.

### **Field Duplicate Sample Analysis**

Field duplicate sample pair (SDG NJ00: GW-080804-PL2-021A-0 and GW-080804-PL2-021A-1) was submitted for alkalinity analysis. Review of the alkalinity bench sheet indicates that these field duplicates had a pH of less than 4.5, a titration endpoint for the method. The alkalinity test was terminated after the initial pH was determined.

### **Data Qualifiers**

Data qualifiers applied by the laboratory have been removed from the data summary report sheets and superseded by data validation qualifiers as follows:

The following qualifiers were used to modify the data quality and usefulness of individual analytical results.

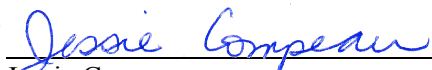
- U - The constituent was analyzed for, but was not detected above the reported sample quantitation limit.
- J - The constituent was positively identified and detected; however, the concentration reported is an estimated value because the result is less than the quantitation limit or quality control criteria were not met.
- UJ - The constituent was not detected; the associated quantitation limit is an estimated value because quality control criteria were not met.
- R - Data are rejected due to significant exceedence of quality control criteria. The analyte may or may not be present. Additional sampling and analysis may be required to

determine the presence or absence of the constituent. For statistical reasons, rejected values are not included in the database.


Y – The reporting limit is elevated due to interference. The result is not detected.

#### Data Assessment

Data review and validation was performed by an experienced quality assurance chemist independent of the analytical laboratory and not directly involved in the project. This is to certify that I have examined the analytical data and based on the information provided to me by the laboratory, in my professional judgment, the data are acceptable for use except where indicated by data qualifiers, which may modify the usefulness of those individual values.

  
\_\_\_\_\_  
Jessie Compeau  
Validator  
Informa, LLC

October 1, 2008  
\_\_\_\_\_  
Date

  
\_\_\_\_\_  
Kent M. Angelos  
Principal Environmental Scientist

October 20, 2008  
\_\_\_\_\_  
Date

#### REFERENCES

APHA, Standard Methods for the Examination of Water and Wastewater, 21<sup>st</sup> Edition November 2007 (updates are available online).

EPA 1999, USEPA Contract Laboratory Program, National Functional Guidelines for Organic Data Review, EPA-540/R-99/008, October, 1999.

EPA 2004, USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Data Review, EPA-540-R-02-003, October, 2004

EPI 2003, Interim Measures Work Plan For Sheetpile Structure at Building 2-66, Boeing Plant 2, Seattle/Tukwila, Washington, Prepared by Environmental Partners, Inc. (EPI), October, 2003.

Weston 2001, Quality Assurance Project Plan Addendum - Groundwater; Boeing Plant 2, Seattle/Tukwila, Washington, Prepared by Weston, April 2001.